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ENGINEERING & MINING JOURNAL-PRESS

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McGRAW-HILL CO., INC.

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By Dr. C. Offerhaus

Silver Mining and Milling at Talache, Idaho
By Felix Edgar Wormser

Mexican Labor
By W. W. Shelby

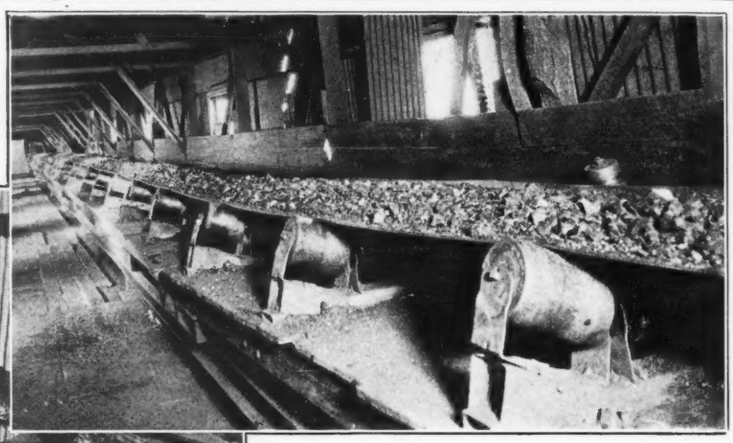
The Sundt-Diaz Flotation Machine
By F. A. Sundt

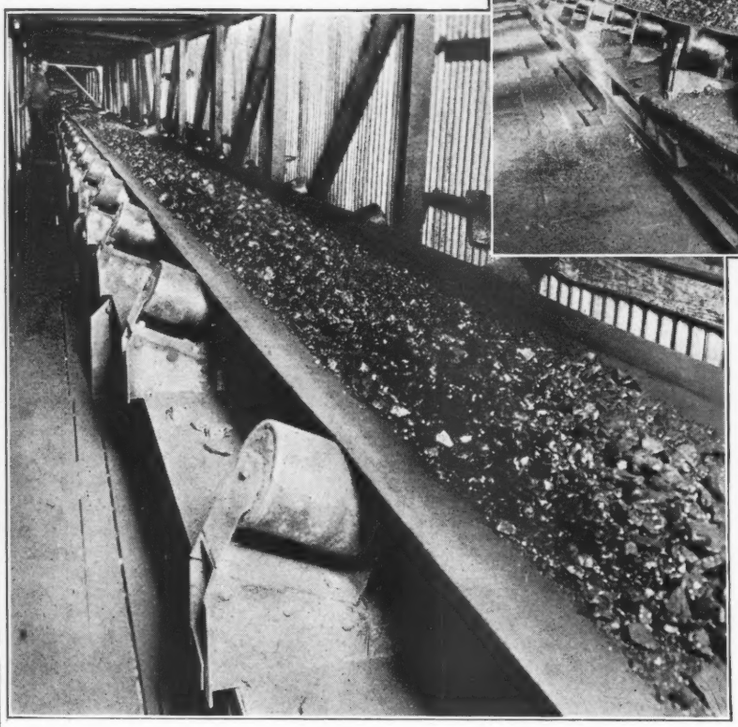
Biography of Milnor Roberts

A WEEKLY JOURNAL REPRESENTING THE WORLD'S MINING AND METAL INDUSTRIES

September 30, 1922

S-A Unit Carriers in re-screening plant of Orient No. 1 Mine of C. W. & F. Coal Co., Orient, Ill.





S-A Unit Carriers in tipple of Zeigler No. 1 Mine of Bell & Zoller Mining Co., Zeigler, Ill.

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Fire Escapes for Mines

THE ARGONAUT fire disaster, in California, has shocked the nation by its loss of life, yet it may be that the miners, like the heroes of Flanders fields, will not have died in vain, if the terrible example will instigate measures to protect miners from a like fate in the future. The burning of the Iroquois Theatre, in Chicago, led to the adoption of the asbestos stage curtain and the provision of adequate fire exits; the burning of wooden excursion steamers in New York harbor led to more rigid inspection and condemnation of such craft. The victims of the Herrin massacre will not have died in vain it thereby there has been awakened in the breasts of the American people the new will to fight for personal freedom. And if the Argonaut fire should be the end of the long list of fire disasters in metal mines, which might have been prevented, the solemn date of the entombment of the Amador County miners may eventually come to have something in it to relieve the sinister recollection.

Why should such pains be taken to render a building fireproof, and less for a mine? Especially why should fire escapes be required by law for a forty-foot building, and none for a two-thousand-foot mine? We are not here referring to the Argonaut. The circumstances surrounding this disaster have been observed on the spot by our contributing editor, Mr. T. A. Rickard, and his articles now running in the *Journal-Press* give an accurate picture as to what actually happened; so in this editorial we leave that out of the discussion. But in general, if a metal mine catches fire less easily than a building—and even this is open to question—a fire in a metal mine is far more dangerous and deadly, because of the poison gases liberated by the burning wood, from which there is often little chance of escape.

The efforts of the Bureau of Mines, which has specialized on mine safety, have been principally in the direction of rescue through the use of gas masks and other devices, after the catastrophe. These methods are valuable, but how inadequate in the face of real disaster is evident. We should like to request the Bureau of Mines to focus its attention on the problem of fire escapes in mines, and once having worked out the solution—and the problem is evidently capable of solution—to devote its energies to seeing that adequate measures are enforced by law.

German Holdings in South Africa

ONE OF THE PROBLEMS left by the War has been the disposal of enemy property. Large blocks of shares in the South African gold-mining companies were held by Germans and Austrians, usually of Semitic blood. These enemy holdings during the War passed into the hands of the Custodian of Enemy Property, an official in the employ of the Union of South Africa. He, Sir Walter H. Fowle, appears to be a discreet and sagacious person. The total assets in his charge amount to $70,000,000, and they belong to about 12,000 persons. Last year the interest account from mining dividends was $2,000,000. From one mine alone, the New Modderfontein, the Custodian has received dividends totaling $4,000,000. It appears that the Public Trustee in England had seized some South African mining shares and had sold some of them, and that these proceeds, together with $1,000,000 in assets, and accrued dividends, were handed over to the Custodian for the South African Union. The Public Trustee sold all enemy shares in companies incorporated in England, and the Custodian sold the shares of companies incorporated in South Africa. He sold them on the advice of his technical adviser, the Government Mining Engineer, but he did not sell them at the market price necessarily; he offered them in the first instance to the groups of companies concerned, and these companies sold them in small lots to their shareholders. The financing of these transactions has been no easy matter, because not many companies have money available for such purchases, so they go to the "groups"—that is, the big firms and syndicates that play so large a part in the mining finance of South Africa. The Custodian holds $40,000,000, which he has invested in British Treasury bills and other government securities. In the Allied countries the property of enemy aliens is confiscated and sold, the proceeds being paid to the Reparations Commission, in accordance with the Treaty of Versailles. In South Africa they are kinder; the Custodian holds the enemy property for thirty years and gives the late enemy a government certificate that bears interest at 4 per cent. Thus in effect the confiscation becomes a compulsory loan. The net result has been to exclude the German banks and German promoters from further participation in South African mining, and by that much to diminish the mining market, which at one time was dominated by German Jews and their associates.

Frankness Between Smelter and Miner

IT IS PLEASANT to note that the American Smelting & Refining Co. is "going vigorously after its problem of creating better will between miner and smelter." That surely is a "problem" that deserves "going after." William Loeb, Jr., a director of the company, is quoted as having emphasized "the mutuality of interest between the miner and the company," particularly in Colorado. This "mutuality" has been emphasized by the stern logic of events, which has shown that unless the managers for the smelting company co-operate in a friendly way with the managers for the mining companies, there may be no ore forthcoming for the smelters in Colorado. Mr. Loeb says, with truth, that "the ability of the Colorado miner to treat at a profit lower and lower grades of ore is due as much to the smelting company's adapting plants and treatment to changing conditions in lead, copper, and

zinc ores as to advances in mining and milling." For example, the modern copper converter has a capacity of 150 tons of copper per day, as against only 10 tons per day thirty years ago. Moreover, the lead furnaces nowadays have been adapted to the treatment of an increased proportion of zinc in the ore, so that the penalties on the zinc are not so severe as they used to be.

In 1913 the cost of treatment at the lead smelters in Colorado represented 32.6 per cent of the gross value of the ore; in 1915, the ratio had fallen to 31.38 per cent; in 1916, owing to war conditions, it rose to 34.9 per cent. The company's profit, it is said officially, has come from a larger business, the net profit on the smelting of Colorado ores from 1912 to 1916 having been only 95c. per ton. This last statement is obscure, because it includes the abnormal period of the War. It would be well if the A. S. & R. told the mining community something definite concerning its economies and profits during more recent years. Frankness and a showing of confidence would do much to promote a recognition of "the mutuality of interest" that should dominate business relations between a smelter and its customers.

The Poetry of Geology

AMONG THE RECENT PUBLICATIONS of the U. S. Geological Survey we find one of an unusual character. It is a topographic map of Mount Desert, the highest and most beautiful island on the New England coast. At the back of this map is a description of the geology of the island by Mr. George McLane Wood, editor for the Survey. Those aware of the sincere work Mr. Wood has done in the proper preparation of the publications of the Geological Survey will expect something eminently readable—and they will not be disappointed. Mr. Wood has described the geologic history and the rock structure of Mount Desert in a manner to make his readers realize—if they have not done so previously—the poetry of geology; and if they have been awakened already to the romance of the science they will appreciate all the more the skill with which Mr. Wood has woven science with literature for the purpose of producing something that is as agreeable to the taste as it is enriching to the mind. It is a pity more of such writing is not available to the public. Unhappily, most geological papers are arid to those with a feeling for literature, and when occasionally a skillful writer essays to present geologic knowledge in an agreeable manner he sacrifices his scientific accuracy in the attempt to be popular. The type of writing that Huxley gave us in his "Lay Sermons" is rare—much too rare.

Touracos and Copper

IN THE BIRD HOUSE up at the north end of the Zoological Park in New York is a cage of touracos, an African bird of brilliantly colored plumage. In the wings is a dash of red, and we are told by the placard that the peculiar thing about this color is that it is caused by the presence of 7 per cent of copper.

A facetious observer has suggested that the feathers of this bird might be made fashionable for the adornment of ladies' hats and other ornamental purposes. The birds would then have to be bred and a substantial amount of copper might be consumed in their diet; say one part of blue vitriol or copper filings to fifty parts bran mash. Possibly by proper feeding the copper percentage of the plumage could be raised, and various shades of color thus secured. Another Western visitor suggested that it is evident that the birds must get their copper from somewhere; that in Africa they probably do a little high-grading at the expense of the Katanga company; and that if liberated in a district where copper had not been found they might make good prospectors if they could be watched. Still another brilliant but unfledged promoter advanced the idea that in some districts of the Southwest insects are plentiful, and the food for a flock of these birds would therefore cost nothing. Their breeding would therefore entail practically no expense, and when in their prime they could be killed and the copper recovered from their feathers by a suitable process. He observed optimistically that fortunes have been made before now on material running considerably less than 7 per cent.

Recent Developments in Dressing Feldspar

UNTIL VERY RECENTLY grinders of feldspar religiously followed methods that have been in vogue so long that the memory of ceramists runneth not to the contrary. It is, then, not surprising that the more orthodox of them are skeptical if not horrified at the milling practice of several companies at Erwin, Tenn. The "standard" methods involve the use of chasers for primary grinding, screens for sizing and cylindrical pebble mills for the final pulverizing. These last are operated on the batch principle; grinding of a charge is continued for an arbitrary period that experience with a particular material has proved to be somewhat longer than is necessary to comminute the particles to a prescribed fineness. By overdoing, a factor of safety is allowed. The process is dry, moisture being removed by preliminary passage through a drier or by natural air drying in sheds.

An innovation a few years ago was the use of a pebble mill operated continuously for the primary grinding; later, vibrating screens were substituted for the less efficient types. A still more radical change was the introduction of "air-separating" equipment in closed circuit with conical pebble mills for the preparation of the final product. This involved the abandonment of the batch grinding. The whole process became continuous; the finished product was the undersize from the separator, the oversize from which returned to the pebble mill for regrinding. Among the heretics whose plants are operated essentially in accordance with the ideas just outlined are the Erwin Feldspar Co. and Willms & Son, both at Erwin.

A still further departure from the usual practice in this country is found in the newly remodeled plant of the Clinchfield Products Co., which is also at Erwin. Here continuous wet grinding in pebble mills is practiced. The flow sheet is simple. Reduction is by stages in Hardinge conical mills in closed circuit with Dorr classifiers. The ground material is separated into two sizes by means of a Dorr bowl classifier. The coarser, suitable for use in the glass industry, is dewatered on an Oliver table filter, and dried on a Lowden drier. The overflow from the bowl is thickened in a Dorr tank, dewatered on a Portland drum filter, and finally dried on a second Lowden machine. This product is most suitable for use in the ceramic industry.

Two novel steps must be mentioned. The overflow from the primary Dorr classifier passes over a coarse-

meshed Hum-mer screen, which effects the removal of an appreciable quantity of flake mica; also, before going to the bowl classifier the ground pulp is passed over Plat-o concentrators, where part of the iron-bearing minerals, principally garnet, is removed. Obviously, if it is possible to reduce sufficiently the content of discoloring impurities of lower grade feldspar by means of ore-dressing processes, large deposits that are not now considered workable will become available. Some ceramists specify less than one-half of 1 per cent iron or even lower, in the feldspar they purchase, so that the elimination must be effective. When the grinding is dry the only method of purification is the discarding, before grinding is started, of low-grade lumps by cobbing, or by hand sorting after coarse crushing.

The expectation of successfully removing deleterious minerals was the primary motive for adopting wet grinding. Another possible advantage depends on the theory that a water-worn particle has certain virtues in the making of pottery that are not possessed by one that is produced by dry crushing. The difference, many times magnified, may be illustrated by comparing the smooth, round surface of a tube-mill pebble with that of a piece of ore that has been cracked to approximately the same size with a hammer. The validity of the theory is a matter of opinion, and opinions on this particular point do not coincide.

Certainly the expense of tabling, dewatering and drying will add appreciably to the cost of the milling operations as compared with that of the dry-ground material. To offset this, one or both of two advantages must be gained: (1) A superior product must be produced or (2) an acceptably pure product must be made from inferior and therefore more cheaply mined material. The plant has not been in operation sufficiently long to demonstrate just what can be accomplished. At any rate, the Clinchfield company and its neighbors at Erwin deserve commendation for their enlightened and progressive technical policy. If the art of preparing feldspar for the ceramist was perfected fifty years ago, it stands unique among industrial arts. Research has revealed better ways of doing everything else—and there is still room for improvement.

To Learn the Truth About Muscle Shoals

FEW PUBLIC QUESTIONS have aroused so much general interest as the Muscle Shoals power development and Henry Ford's offer to take it over and carry it to completion. It is proposed that the Tennessee River at this point in northern Alabama should be impounded by a dam 100 ft. high and about one mile long which will develop 100,000 hp. at times of low water, and up to 300,000 hp. for about half the year. The cost will be about $50,000,000. These are the fundamentals of the proposition. Residents of the South within hundreds of miles of the proposed development feel that their future happiness depends upon the acceptance of the Ford offer. Politicians, who, in general, know little or nothing of what they are talking about when engineering subjects are up for discussion, and occasionally at other times, have found this a particularly good topic on which to harangue their constituents. Wild talk has been common from all quarters.

Now it is proposed to settle this question as well as it can be settled, and the voluminous testimony is all to be turned over to a group of prominent engineers for investigation and report. They will endeavor to determine what the possibilities of Muscle Shoals really are; whether or not the Government should carry the project through to completion; and whether or not Ford's offer should be accepted. In other words, they will present to the people the facts, as opposed to visionary hopes and fears. For this, the country will be indebted to the Federated American Engineering Societies, by which the investigation is to be sponsored. It promises to be the most important work which that organization has yet undertaken, and may help to answer the query as to how the federation can make itself useful.

Mining in Russia

THE RECENT ANNOUNCEMENT that an agreement had been signed between the Soviet government of Russia and the Russo-Asiatic Corporation (headquarters in London), whereby the latter was granted a ninety-nine year lease on mining properties in the Russian Urals and Siberia, has aroused great interest as indicative of the growing change in the attitude of the Bolshevist government. The concession includes all the mines formerly worked by the company. The comment of the newspapers, however, was largely to the effect that the signing of the agreement was rather of a diplomatic and protective move on the part of the Russo-Asiatic Corporation than an indication of immediate resumption of former activities. The inference was shrewdly drawn that the company would be in no hurry to place its head in the Bear's mouth till it was fully satisfied of its well-fed condition and reformed and philanthropic intentions.

It is as difficult for Americans to understand Russia as for Russians to comprehend America; but a recent article in the "Review" published by the London County Westminster and Parr's Bank, Limited, gives a clear picture of the great Bolshevist adventure to date.

The writer (anonymous) points out that the first phase of Bolshevist power lasted from October, 1917, to the beginning of foreign intervention in the fall of 1918. This was the period of nationalization of land and partially of other property, and of the disintegration of the established order of industry and civilization. There was little violence and terror. The second phase was the period of civil war and foreign aggression. Russian attacks on the Bolshevist power were made by Denikin, Kolchak, Wrangel, and others, aided by the Allies; and there was also war with bordering states like Poland, Lithuania and Finland. These attacks strengthened the Bolshevist cause through the development of patriotism, but also brought on the bloody Terror, and the suppression of all liberties. This period lasted from the autumn of 1918 to the spring of 1920. Then began the third phase of the revolutionary history, marked by the rise of a Moderate party within the Bolshevist ranks, protesting against useless bloodshed and tyranny. The struggle between the Moderates and the Extremists is still going on, and is the keynote of the present situation. At present the population of Russia desires peace—and food; it longs for safety and fixed conditions. The belief has grown up that this could best be accomplished by a modification of the government rather than a new revolution; complete hunger and prostration contributed to this philosophy. But famine also helped strengthen the pressure on the Soviet government for change; and under these economic stresses a definite departure from Bolshevist theory was made: the "New Economic

Policy" was proclaimed, which permitted private trading in town and country. This magically transformed Moscow from a dying city to a busy market, and increased the spirits of the people. At the same time the government began to de-nationalize the factories. This new policy was attacked by the Extremist party and supported, of course, by the Moderates. In fine, the existing situation is thus explained, and the struggle is likely to be somewhat protracted, for, as the writer whose article we are summarizing remarks, "Communist dogmas retreat ungracefully before the compelling force of economic events."

Under the circumstances it is evident that those who wish to mine in Russia and Siberia—and they are many—will naturally come to terms with the Moderate group of the Soviet government, and will move forward step by step as the Moderate policies become fixed and reliable; but will, if they are wise, be just as well prepared to beat a quick and harmless retreat if and when Extremist policies recrudesce. In other words, the reconstruction of Russia will be slow, and, like the crust of the earth, subject to alternating up and down oscillations, which nevertheless in Russia probably punctuate a general uplift.

THE JOURNAL-PRESS STAFF

ALLAN HILDRETH HUBBELL

CREDIT for developing the *Journal-Press* into the leading mining newspaper of the world belongs in large measure to Allan Hildreth Hubbell, who, before his advancement to the post of Managing Editor of the paper, had for some years been acting as News Editor.

Hubbell was born in Brooklyn in 1885. He was graduated (A. B.) from the College of the City of New York in 1904 and from the Columbia School of Mines in 1908. As a student he visited the iron and copper country of Michigan, and soon after receiving his E. M., was engaged as assistant mining engineer for the Tennessee Copper Co., at Ducktown, Tenn. Thirteen months later the call of the West took him to Colorado, where he spent the greater part of the following year working in the mill of the Portland Gold Mining Co., at Colorado Springs; the Globe Smelter, at Denver; and in the Daly-Judge mine, at Park City, Utah. During this time he also visited the mines of Cripple Creek, Leadville, and Bingham. Among the properties inspected at Leadville were those under the management of Samuel D. Nicholson, who took him about the workings, and who, according to Hubbell, never said a word about his intention of becoming a United States Senator.

From Park City Hubbell went to Marion County, Fla., an opportunity having presented itself, on the examination and testing of phosphate lands. This work completed, he returned to New York, expecting to go back to Florida later. The anticipated financing of the property did not materialize, however, with the result that within a few months he found himself in the Southwest. After working at Mogollon, N. M., for the Socorro mines for a few months, he went to the border, intending to go to Mexico. He decided to change his plans, however, as it was then that the insurrectos were becoming increasingly active, with a consequent retarding effect on operations. Following various interesting experiences, he went once more to Utah, where, to replenish the treasury, he worked, as so many other technical men have done, at the Magna plant of the Utah Copper Co., at Garfield. Eight months later he was offered the position of assayer for the South Utah Mines & Smelters, at Newhouse, Utah, which he held for two years. While with the South Utah company he married Lillian Forbes, of Brooklyn. The final shutdown of this Utah property becoming imminent, Hubbell came East, having decided to give up mining. Once in

ALLAN HILDRETH HUBBELL

New York he made his entry into the mail-order business as an assistant head of a department handling a mailing list of several million names and eventually became assistant to the operating superintendent of the Charles William Stores. The attraction of the mining industry was strong, however, and when the *Journal* in 1917 advertised for a candidate for a vacancy on its staff, he applied and got the job.

Mr. Hubbell's work as News Editor—his familiarity with the task of sifting out the worth-while news from the mass of material that came to his desk—was facilitated greatly by his studies in the field and by his inspection trips in behalf of the paper, and provided valuable experience and technical equipment for the Managing Editorship, which he assumed on Aug. 15 of this year. In addition to his executive duties, Hubbell edits the department running under the head of Useful Operating Ideas and finds time, furthermore, to make frequent contributions to the editorial pages. Also, he edited and contributed much material to the By The Way page for three years.

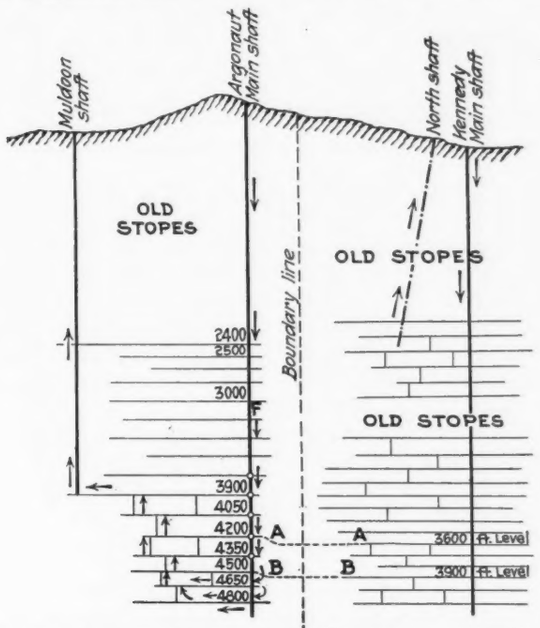
Mr. and Mrs. Hubbell live in Queens, Long Island. They have two small children, a boy and a girl. Hubbell is a member of the A.I.M.E. His favorite indoor sport is trailing and flailing the fraudulent promoter.

The Argonaut Disaster

By T. A. Rickard

EARLY this year the Kennedy Mining & Milling Co. brought suit against the Argonaut Mining Co. for negligence in not preventing the fire of 1919 from extending into the Kennedy workings and for trespass in having removed ore that had been left as a barrier at the common boundary of the two properties. The Kennedy claims damages of $500,000. On the other side, the Argonaut has filed a cross-complaint and alleges that the flooding of the two mines would have been unnecessary if the Kennedy had taken precautionary measures to prevent the fire from extending into its own ground. The Argonaut demands $800,000 as compensation.

The managements of the two mines have not been good neighbors and the owners of the Kennedy have made attempts to buy the Argonaut—as was entirely logical under the circumstances. At an earlier date they had the usual apex suit, which, of course, tended to check access from one mine into the other. If they had been on friendly terms it is probable that communication between the workings of the two mines would have been established and a joint system of ventilation would have been arranged to their mutual advantage. If that had been done the disasters that have befallen them both by the mishaps of one of them might have been mitigated or even avoided. The Kennedy was located by Andrew Kennedy in 1855; both are relatively old mines with a history exemplifying the usual vicissitudes of mining on the Mother Lode. Both have done well during the last ten years.



The principal workings of the Argonaut and Kennedy mines, projected on a vertical plane.

"F" marks place where fire started. Arrows indicate the ventilation. "A-A" and "B-B" mark lines of rescue from the Kennedy. The small circles at line intersections mark doors to stop draft.

Next comes the vital question of ventilation, upon which depend the health, and even the life, of the men working underground. The Argonaut has two shafts. The main shaft is used for hoisting and pumping; and by means of it the miners go to and return from their work. The Muldoon shaft is the secondary exit; it has a hoist that can be operated to a depth of 800 feet only; below that the shaft is no more than a system of linked raises, down to the 3900-ft. level. From the bottom level, 900 feet deeper, the only secondary exit is by means of the raises that connect the successive levels on the south side of the main shaft. A system of ventilation is maintained by means of a Sirocco fan at the Muldoon shaft; this fan has a nominal capacity of 60,000 cubic feet of air per minute; it sucks the air out of the mine and thereby makes the main shaft a downcast. In order further to direct the fresh air into the bottom workings, the upper levels where they connect with the shaft on the south side are closed by doors, whereas the 4500, 4650, and 4800 levels are left open, so that the air is forced down the main shaft, past the upper levels, into the deepest three levels, up the raises to the 3900-ft. level, along that level, and up the Muldoon shaft. The 47 men were working on the lowest three levels, south of the main shaft. The ventilating system of the Kennedy forms a separate unit, because the workings of the two mines do not connect, although some leakage of air from the Kennedy is claimed to exist at the horizon of the 4200-ft. level of the Argonaut.

It is evident that as soon as the fire started in the main shaft the established system of ventilation would cause the smoke to go where the men were at work and to enter the only other exit, the Muldoon shaft. The question arises immediately, should the fan have been stopped or even reversed? This is already a subject of earnest controversy. To me it seems obvious that the stopping of the fan and the reversing of the ventilation offered the only chance for the escape of the men at the bottom of the mine. The heat of the fire would cause the air to ascend in the main shaft and any opposite momentum left from the artificial ventilation, after the fan had been stopped, could be checked promptly by closing the top of the Muldoon shaft for a time. It would not be necessary to reverse the fan—to do that, I find, would have required many hours, because the fan is not constructed so as to be reversible quickly. If then the air currents had been turned, the men might have climbed out of the mine through the Muldoon raises, provided the ladders were in good repair. It would have been no easy escape, for to climb 5000 feet of ladders would require six or seven hours and could be done only by an athletic man, but at least they could have reached the bottom of the Muldoon at the 3900-ft. level and there awaited food and succor. If the fan was not stopped the lower workings of the mine would become a deadly trap; the men would be caught even worse than a rat in a trap, for many of the rats in the Argonaut mine did escape through the Muldoon shaft.

Most of the experts, however, insist that it was right not to stop the fan. They insist that it is a first principle, at the time of such a disaster, to not reverse the ventilation, because any change is confusing to the men that are entrapped: they plan their safety on the assurance that the ventilation will remain as they know it. To this I would reply that no cast-iron rule should be established, because the conditions are never exactly

the same in any two mines, and to stick to a rule may be to court disaster. In the present instance, this basic principle meant, it seems to me, that the men were denied their only way of escape.

Next it is argued, by others, that the ventilating-doors on the upper levels were not entirely effective, that some leaked or were even open, and that therefore there was a short-circuiting of the air currents, so that the smoke and gas were not led immediately to the bottom workings. I have information to the contrary, namely, that only a few hours before the disaster there was an excellent draft from the shaft into the 4800-ft. level. It is unlikely that the men working there would be left dependent on the compressed air that they used for drilling. Furthermore, supposing that the ventilation was partly short-circuited along the upper levels, that is, along the 3900, 3000, and 2400, the effect would be to deaden the air of the lower workings and to send the smoke from the main shaft into the Muldoon connections above the 3900-ft. level, thereby again preventing escape through the Muldoon shaft. It seems to me that one major chance for the escape of the men from the bottom of the mine was lost when the Muldoon fan was not stopped as soon as it was known that the main shaft was on fire. Of course, the first hope was to extinguish the fire, but the impracticability of doing that became evident very soon. The victims would not have suffered from the smoke that came first so much as from the gases produced later from the destructive distillation of the woody fiber of the timbers in the shaft. This matter deserves careful debate as a guide on the occasion of similar accidents in the future.

DISCUSSION

Training Machine Miners

THE EDITOR:

Sir—After reading several articles dealing with the present shortage of machine miners, I feel that one of the foremost factors in the case has not been duly appreciated by the press. It is my belief that the difficulty may be traced in large part to the use of the one-man machine.

In any trade or profession it is essential that young men be developed to take the places of older men who are retiring from active work for either physical or economic reasons. In the mines, the training of young men presents certain features which differ from those encountered in other callings. The miner cannot, as a rule, become somewhat acquainted with his calling from boyhood, as the minimum working age for underground employees is necessarily higher than for surface trades. But when we cast about for recruits for the drill-crank we naturally expect to find many among the young men just coming into the age of "man's work." In fact, many lads of eighteen to twenty are found "breaking in" underground—often because of family necessity, often because of the young man's desire for man's wages. But how many of this number, after a few weeks or months of shoveling or tramming, evidence a desire to break in on a machine? My own observation, amply supported by recent laments in the press, is that the number is relatively small.

The miner of recent years, the man who helped put Butte, the Coeur d'Alenes, and Bisbee on the map, who knew Goldfield and the Comstock at their height and could tell countless tales of the high-grade days of Cripple Creek, is rapidly passing. Not a few have departed to the "widow-maker's" boneyard. The boom days of mining are largely in the past, and the industry is coming into the category of ordinary business, which means that we must be governed more and more by the principles which have been established in other industries. But the most important feature of any business, we find, is its personnel; more especially in ours, where the manual worker is dependent on his own skill and initiative and is not under constant supervision. We depend upon two sources for our supply of manual workers—namely, the immigrant miner and the young man who must learn his occupation in our mines. The ingress of the foreign-born miner has been greatly reduced and is likely to remain so for several years, wherefore we must encourage increasing numbers of our own young men to go into the occupation of mining.

The younger underground worker of today often looks at underground work as a temporary job—something to provide a living until he finds something better—and he is not interested in acquiring skill as a miner; second, he has been imbued with a genuine fear of the dust produced by the dry machine and does not fancy the grief attached to the operation of the Leyner-type of drill; third, he lacks the experience necessary to the successful drilling and breaking of rock and is given no opportunity to acquire it in a rational manner, since he cannot serve as helper on a machine which requires but one man for its operation.

Of these the last is the governing factor. The intelligent operation of the machine drill is a less arduous, more interesting task than shoveling or tramming, and the higher wage attached to machine work should make it the preferable occupation. The objectionable dust can be, and is being, nearly eliminated by the purchase of water-type machines in the replacement of present dry equipment. Furthermore, the grief and vexation attached to machine drilling are due mainly to inexperience or lack of proper training. The old timer on the drill is seldom found with a steel stuck so tightly in a hole that nothing less than a compound chain block could move it; neither does he try to "get by" with a poor set-up nor count only nine holes when twelve were spit. He knows by experience the easiest, quickest way to accomplish each purpose and he saves his temper and the skin on his knuckles. Neither the butcher, the plasterer, nor the miner can learn the practice of his trade in a night school. It takes experience to drill and break a round of holes in hard, tight ground.

But if the young underground worker of today is given the opportunity to learn the practice of machine drilling in a rational manner, and is given the decent working conditions which progressive companies have found essential to real economy of operation as well as for the health and satisfaction of the employee, enough new blood will be attracted into mining work to offset the loss. And we will be building a personnel of American miners which will prove of incalculable benefit to the industry. However, to put a man on the business end of a shovel in the near vicinity of a drilling machine is not a rational manner of teaching him the operation of that machine. If he is an industrious worker, the shovel will engage his attention to the exclusion of the machine, and if he is lacking in industry he will never succeed as a driller in any event.

The logical order of progress in the school of mining experience is stope, raise, and drift. Shaft work is usually entrusted to men who specialize in sinking, and need not be considered here. By first teaching the novice to drill a stope cut he may be acquainted with fundamental principles of drilling and breaking ground under such conditions that an error in operation will not usually spoil an entire shift's work. As soon as he has acquired confidence in his ability to handle drill and powder to advantage he may be put in a raise with a good miner as partner, where he will learn the why and how of pulling a cut. It will then be best to start him in drift work as soon as possible.

One of the best methods which I have encountered for the training of the young miner is the "day-shift drift"—the term is my own. This method is applicable to large mines where a part of the lateral development may be pushed at sufficient speed by one two-man shift per day. Here it is possible to give an experienced miner a young man as partner, with the understanding that the drift (or crosscut) will be drilled and blasted one day and mucked out the following day. Where possible, two machines may be mounted and the novice will quickly get the hang; where only one machine is in use it is best for the two men to take alternate shifts "on the crank." It will usually be found that the round will be drilled out in good time, so that the entire work of timbering and extending track and pipe lines can be handled by the two men. Work of this nature will often appeal to the young man strongly—the all-day-shift feature in particular.

The night school as an adjunct to practical experience should be of some value. Attendance should not, of course, be directly or indirectly required unless some form of remuneration is made for the time spent. One meeting each week should be sufficient for each class. The elimination of the chuck tender from the payroll has made possible a considerable saving in the mine labor bill, but a portion of that saving must be returned to the worker as the cost of practical training.

Kingman, Ariz. DONALD C. GILBERT.

The Prospector, Scout, Exploration Company, and Revision of the Mining Law

THE EDITOR:

Sir—The venture of finding new mines is essentially a risky and speculative undertaking. And since nearly all the surface outcrops have been discovered, it is now largely a geological process of interpreting obscure conditions to reveal the hiding ground of ore deposits from fewer surface indications and data. This is the future province and work of an outdoor rough-and-ready, find-the-ore geologist, trained to the task, resourceful, observing, and ambitious to succeed. It is not that of the old-time prospector nor the soft-palmed scout; both having failed—having demonstrated their disqualifications for this class of work—they are fired. Besides, this work belongs to the new specialist alone, who will need both of them for his assistants—they are hired. In different phrase, Prof. C. K. Leith, in "Economic Aspects of Geology," page 301, expresses this view of future explorations. As to the so-called exploration companies; where "smart practices" fail, straightforward methods may succeed. Shifting the whole burden of discovery and risk onto those least able to carry it—the prospector and miner—is a threadbare trick unworthy of a bolshevik. Those concerns indisposed to assume their share of the venture in mining adventure should get out and stay out. Then others of superior genius and finer mould will come forward ungrudgingly to help the skilled delver in exploratory work; because the ambition to prospect and explore is elemental.

The proposed new mining law is a recognition of the demands of a new cycle in mining. The old law, which is a sort of Joseph's coat affair, a patchwork of discrete customs, did service in the past, between the pioneer and the prospector. The new law will lie between the miner and public welfare as against Mammon. The scattered remnant of prospectors have but little to gain or lose; but the subsoil miner and the surface public have more at stake than ever before. The miner and the public should have "a friend in court," as it is told that Mammon never sleeps. The miners' interests coincide with those of the public; Mammon's should but may not. So whether or not this proposed new law will be a benefit or disappointment, depends. If the "still small voice" is heard above the clamor of the crowd, the new law may be a "Dead-Sea fruit" to the miner and the public. The tendency to reaction was pronounced in certain provisions of the Arentz Bill, introduced in the Sixty-seventh Congress, which was so displeasing, in fact, that the miners intuitively arose as a unit against it. But a new law is needed, and a bill of some kind will pass before long, good or bad.

The U. S. Geological Survey is engaged in the good work of trying to classify and segregate non-mineral from mineral lands. This new mining law should and could assist in this important work. But with heedless indifference to the Survey and to economic laws, the Arentz Bill made no reference to nor distinction between surface and subsoil rights and values; but spent its energies, largely, in jumbling these separate entities in an unscientific scheme to force by patent the public domain into private hands.

The average working life of a mine is eleven years. For purposes of taxation, the mines and mineral deposits are classed as "wasting assets." The idea of forcing patents, good for eternity, on such transitory possessions is ridiculous. A U. S. Land Office record is all the title the miner wants or needs. Besides, the country has been "raked from Alaska to the Rio Grande" and "thrown down." So we may hope that many if not all of these objectionable features will be removed from any substitute bill. Surface right is common rent-paying land; subsoil right is crown or royalty-producing land. Nearly every civilized government, except the United States, makes and applies this distinction, and the United States should apply it. Surface

right has only rental value. Subsoil right has both rental and royalty value. Surface land is worth no more to the miner than it is to the homesteader, which is $1.25 per acre. The value of subsoil land is indeterminate, and measurable only by royalty on output or net production. The miner does not use the surface land as a homesteader, but displaces it for subsoil or mining purposes. Hence, he stands in the position of a renter of surface land, and payer of royalty to the state, instead of taxes, on the output or net production of the methods and minerals produced from his underworld mine. The unwisdom of confusing and merging these two unlike entities, and forcing the miner to pay or patent at $5 to $50 per acre, is reaction pure, simple, and putrid.

The square forty-acre, or sixteen-hectare, claim, with the homesteader's right of five years, if needed, to "prove up" or find ore, but without extralateral rights, is what the prospector needs and the miner demands. The individual right to locate and own four forty-acre lots, or 160 acres in all, is the limit of privilege at any one time. Therefore the right to relinquish or abandon is provided. As to obligations dependent on possession; an annual rent of 25c. per acre for surface areas, or $10 per annum for each forty-acre claim, to cover Land Office fees for record and affidavits of annual assessment work, would be suitable. The annual work of $100 to be expended on the ground in developments, looking to the finding and mining of ore, is a subsoil obligation of twenty days' work. Thus, the annual cost for each forty-acre claim would be $110. Crown royalties are based on average government bond and bank rates of interest, and not on the "cut-throat principles" of Mammon. Hence, they would range from 3 to 7 per cent on net mint, mill, or smelter returns, and stand in lieu of all other federal taxes.

Finally, a blanket federal "Subsoil License Permit" at $5 per year to all, graded for and from the prospector, miner, engineer, to the geologist. The license to designate character and rank, and excluding any and all citizens from locating, owning, operating, surveying, or examining mines and metalliferous deposits without it. All citizens of good repute, past seventeen years of age, entitled to the prospectors' and miners' grades, on application and approval. This feature alone would dismiss, without notice, the whole generation of pseudos, come-ons, rakers, parasites and pig-in-the-poke promoters at "one fell swoop." S. F. HUNT.

Montello, Nev.

Questions the Opportunities in the Camp of Guanaceví

THE EDITOR:

Sir—I beg to call your attention to some errors in "The Camp of Guanaceví," by Alberto Terrones Benitez, published in the *Engineering and Mining Journal-Press* of July 22:

"In his trip across Mexico, Humboldt visited it" (p. 139). On all of his travels over Mexico, Humboldt never got north of Guanajuato.

"At present there are 1,124 claims that have been denounced, their titles not being issued as yet." From January, 1916, to January, 1922, or during the last six years, 698 applications for mining concessions were filed for registry at Guanaceví, and only 187 were accepted for proceedings. Of these, about fifty-seven were titled, and, consequently, a total of 130 remain pending final resolution. Of the latter a goodly number have been disposed of, either by voluntary withdrawal or by disapproval on the part of the Department of Mines. It can safely be assumed that by the beginning of 1922, not more than sixty to seventy denouncements were pending at Guanaceví.

"The capacity of the camp" (page 14) is given as a total of 1,500 tons of ore per day, with the following average grade: 2,267 g. of silver and 5.2 g. of gold per ton. If this were true, Guanaceví might be located almost anywhere on the globe, and surely money would not lack to make the camp one of the most lively spots.

As a matter of fact, the following figures represent the bald truth: During about two years' operations covering the Santa-Cruz-Garibaldi group of mines, and covering the same period concerning the Arianeña group of mines, high-graders, (*buscones*) were able to mine a total of 1,277 tons of ore with an average assay value of 2,260 g. of silver and 2.26 g. of gold. Since the high-graders were paid according to tonnage delivered and assay value was determined by sampling, this ore represents fairly well the actual possibilities at Guanaceví. The grade of ore given by Terrones Benitez coincides almost with actual conditions, but the tonnage given by him is out of all proportion.

The truth is that all the mines existing at present are more or less worked out, no new orebodies have been developed anywhere, and the grade of ore given represents about the best high-graders can produce in exceedingly limited tonnage.

THE RAILROAD PROBLEM

Years ago, Mr. Johnson, who was chief engineer of the International R.R., said: "Guanaceví is very well protected from a railway." This opinion was expressed after he had made a preliminary survey and engaged in extensive investigations as to the probable freight possibilities.

Mr. Terrones Benitez mentions a freight possibility of 601,000 metric tons of ore. This is rather low for a railroad extension from Tepehuanes to Guaneceví, a rail distance of 100 to 120 km. Besides, of the 601,000 metric tons, the greater part is mere rock and would not stand freight and smelter charges to Velardeña or Torreón.

It is a curious fact that every once in a while considerable railroad talk about Guanaceví flutters through newspapers, but every time, when cold figures as to cost, operation cost, and freight possibilities are looked into at close range, all enthusiasm dies rather suddenly.

"Guanaceví presents an opportunity" (page 144). Guanaceví is a rather throughly worked-out camp and the old *cascarones* (worked-out mines) will never produce any considerable tonnage of any kind of pay ore. But for this, we will let Mr. Terrones Benitez speak for himself:

On page 142 he says: "At a depth of 150 m. the veins become too poor to be worked under the present circumstances." On page 139 he says: "The camp produced ores to the value of 500,000,000 pesos." On page 141 he says: "The mineralized country, which covers an area of 4,800 hectares." Putting these three things together, I fail to see where the opportunity comes in, unless Mr. Terrones Benitez has in mind the fact that "a sucker is born every minute."

Further comment is superfluous.

Mèxico, D. F. PAUL X. STOFFEL.

Silver Mining and Milling at Talache, Idaho

A Narrow Silver Vein in the Coeur d'Alenes Which Is Being Successfully Worked—Modern Flotation Plant Built to Treat 150 to 200 Tons per Day—Pittman Act Influenced Design and Operation of Equipment

By Felix Edgar Wormser
Assistant Editor, *Engineering and Mining Journal-Press*

ONE MIGHT HAVE TO LOOK long and hard at a map of Idaho to find the location of Talache. A few years ago the name of this village in Bonner County would have passed unnoticed, but the development of an extremely interesting silver deposit, with its attendant activity and settlement, has added

Lake Pend Oreille looking northeast

greatly to Talache's prominence. In fact, the visitor traveling by rail from Spokane sixty-five miles to Sagel —a typical Western box-car station near Talache—will notice the new ore bins situated alongside the railroad tracks and can readily sense the presence of a mine. It is six and one-half miles from Sagel to Talache over the Talache Mines Co.'s new road, but the camp can hardly be termed isolated. The village of Sandpoint is twelve miles north and Spokane two and one-half hours, traveling south. Its proximity to larger communities and beautiful location combine to make Talache an ideally placed small mining center.

The mine is situated about three-quarters of a mile from beautiful Lake Pend Oreille, in a heavily wooded area. The panorama of mountains and lakes unfolded from various points near the mine is magnificent. The cleanliness and newness of everything about Talache are in keeping with its surroundings. I am informed that Talache is the Mexican name for a crude form of pick which was extensively used in earlier days for mining purposes. A certain tribe of Mexican Indians was almost entirely engaged in the mining of silver ores, and finally came to be known as the Talache tribe, from their universal use of the crude pick, *talache*.

In the fall of 1916 an option was taken by Major H. H. Armstead on the Little Joe, Keystone, and other groups of claims. In February, 1917, the properties were purchased by Major Armstead and associates, and title passed to the Armstead Mines, Inc. In the spring of 1922 Major Armstead sold his interest in the mine, and the name was changed to Talache Mines Incorporated. A long tunnel was driven to cut the main silver vein on the property, the "Little Joe," and at 3,500 ft. from the portal achieved its object. That was in February, 1918. The tunnel is the main entrance and corresponds to the 1,200 level of the mine. At 4,000 ft. it connects directly with an inclined raise driven at 60 deg. to the horizontal for a distance upward of 916 ft. The 1,200 level gives a depth of about 1,750 ft. on the vein, which strikes north 10 deg. east and has a dip of 30 to 60 deg. east. As the vein and inclined raise have different dips they intersect at the 700 level—levels being 100 ft. apart vertically. Drifts, crosscuts, and raises have developed the vein on its various levels.

The Talache mine at present draws its entire output from the Little Joe vein, one of the series of parallel veins on the property of the company. The vein is narrow but persistent, and roughly parallels the bedding of the metamorphosed country rock or part of the Belt series in which it is located. A slight difference, amounting to perhaps 10 deg. between the dip of the country rock and the vein, would indicate by its persistence that it will extend to a greater depth than anticipated. It is a typical fissure vein, in many places exhibiting a banded structure. The country rock is either the St. Regis or some equivalent shaly quartzite characteristically deep purple and green in color, which lends an attractive color scheme to the mine dumps.

The Little Joe vein may be traced for one-half mile on the surface, but faults of evidently large displacement and heavy overburden prevent its being exposed over a longer distance. Underground it has been developed in a northerly and southerly direction for about

View of north side of the Talache mill

1,700 ft. The vein varies in width from one inch—or pinches out entirely—to five or six feet. Its average width is 16.5 in., and average dip is 45 deg. Occasionally the vein is frozen to its walls, but usually it breaks cleanly from them. It has been estimated that in only about 20 per cent of the working places is the vein so frozen.

Besides deing irregular in width, the vein has been subjected to normal faults of moderate and small displacement, the largest movement being about 150 ft. and minor ones perhaps 25 ft. Rolls, slips, pinches.

Company hotel *Post Office* *Mill, tunnel entrance and shops*

Panorama of Talache, Idaho, showing entire surface plant

and swells add to the intricacy of the geology and irregularity of the vein. In short distances it is not uncommon to witness the vein swell from a few inches to five feet. Small basic dikes in the mine and exposures of granite rocks close to the mine attest to the igneous origin of the deposition. Although conditions, broadly speaking, are similar to those found in the lead silver mines of the Coeur d'Alene around Wallace, silver is found chiefly in tetrahedrite, not in galena.

Despite the smallness of the vein, it is rich in minerals. Siderite, pyrite, chalcopyrite, sphalerite, galena, arsenopyrite, tetrahedrite, and quartz are the most prominent, but bornite, stibnite, and hübnerite have also been identified. A typical analysis of Talache ore follows:

	Per Cent
Silica	67
Siderite	12
Pyrite	6
Chalcopyrite	2
Sphalerite	3
Galena	1
Arsenopyrite	1
Gouge and other material	8

The silver content of the vein averages 12 to 20 oz. Up to Jan. 1, 1922, over 16,000 ft. of development was recorded, and at that time ore reserves were estimated to be 110,000 tons, carrying 0.09 oz. gold and 17.5 oz. silver. Pockets of very rich ore are found at times. Along the intersection of a small cross fissure and the vein on the 700 level there is a small body of ore assaying 1,000 oz. in silver. Pockets of high-grade ore are found in other parts of the mine and tend to bring up the average grade. Sorted ore received from lessees averages about 350 oz. silver.

The inclined raise connecting the 1,200 or adit level and the 400 or old working level is constructed in three compartments. The center compartment contains rails and a skip specially built for the hoisting and lowering of men, timbers, and supplies. The two outside compartments are respectively waste and ore chutes through which the ore and waste are passed from the upper to the lower levels, ultimately reaching the 1,200, where they are hauled by storage-battery locomotives 4,000 ft. to the mill or dump. The ore is controlled in its fall in the chutes by arc gates on each level. Thus the mine is not subjected to any ore-hoisting expense and only men and supplies are hoisted. The ore chutes give a fair amount of storage space. Drainage on the various levels is toward the "Main Raise." The water is collected at the different level stations and piped to the 1,200 level, where it flows by gravity to a tank at the portal and is used in milling without pumping.

The vein is narrow enough to cause difficulty in mining, especially at its lesser dips. The general practice followed is simply to provide a working space in the stopes just high enough for comfortable working, then to break the faces of the stopes in two steps, the first removing the waste and the second step mining the narrow vein. Especial care is exercised to avoid contamination of the rich vein matter with the country rock, and careful sorting underground is the rule. The waste forms convenient filling, which is carried as close to the faces as possible. More than enough waste is supplied for stope-filling purposes, and the excess is trammed to the dump. The ground only stands well for short unsupported distances, and although not so heavy as that in other Coeur d'Alene mines, requires constant timbering and filling to prevent caving. The vein is not wide enough for the use of square sets, ordinary lengths of stulls and headboards and subsequent waste filling being sufficient to support the mine workings. In many stopes the pitch of the vein is not steep enough for the ore to run smoothly, so that considerable shoveling is required, but generally only a small amount is necessary. A low pitch of the vein necessitates removing more of the walls to expose the vein in the stopes than where the pitch is steeper. Chutes have been provided at 33⅓-ft. intervals to minimize the amount of shoveling required. Owing to the narrowness of the vein, mining costs are high. For July, 1922, they were $6.48 per ton.

The Talache mine is a silver mine, and like many others producing the white metal is greatly affected by the operation of the Pittman Act. In fact, that bit of silver legislation has had a profound influence on the development of the mine and the design of the mill.

Offices *Employees' cottages*

with the exception of the compressor, boiler house and assay office

On March 1, 1922, the new mill was started, and concentrates were shipped to the East Helena lead smelter of the American Smelting & Refining Co. At the time the mill was designed a paramount consideration in operation was to take maximum advantage of the dollar silver provisions of the Pittman Act. Hence the mill was designed to treat a larger tonnage than originally contemplated, which naturally involved mining a larger daily tonnage of ore. Construction was rushed as quickly as possible under the circumstances, and the actual erection of the mill began on Aug. 1, 1921. It started operating on March 1, 1922.

Talache Mill Has Level Location

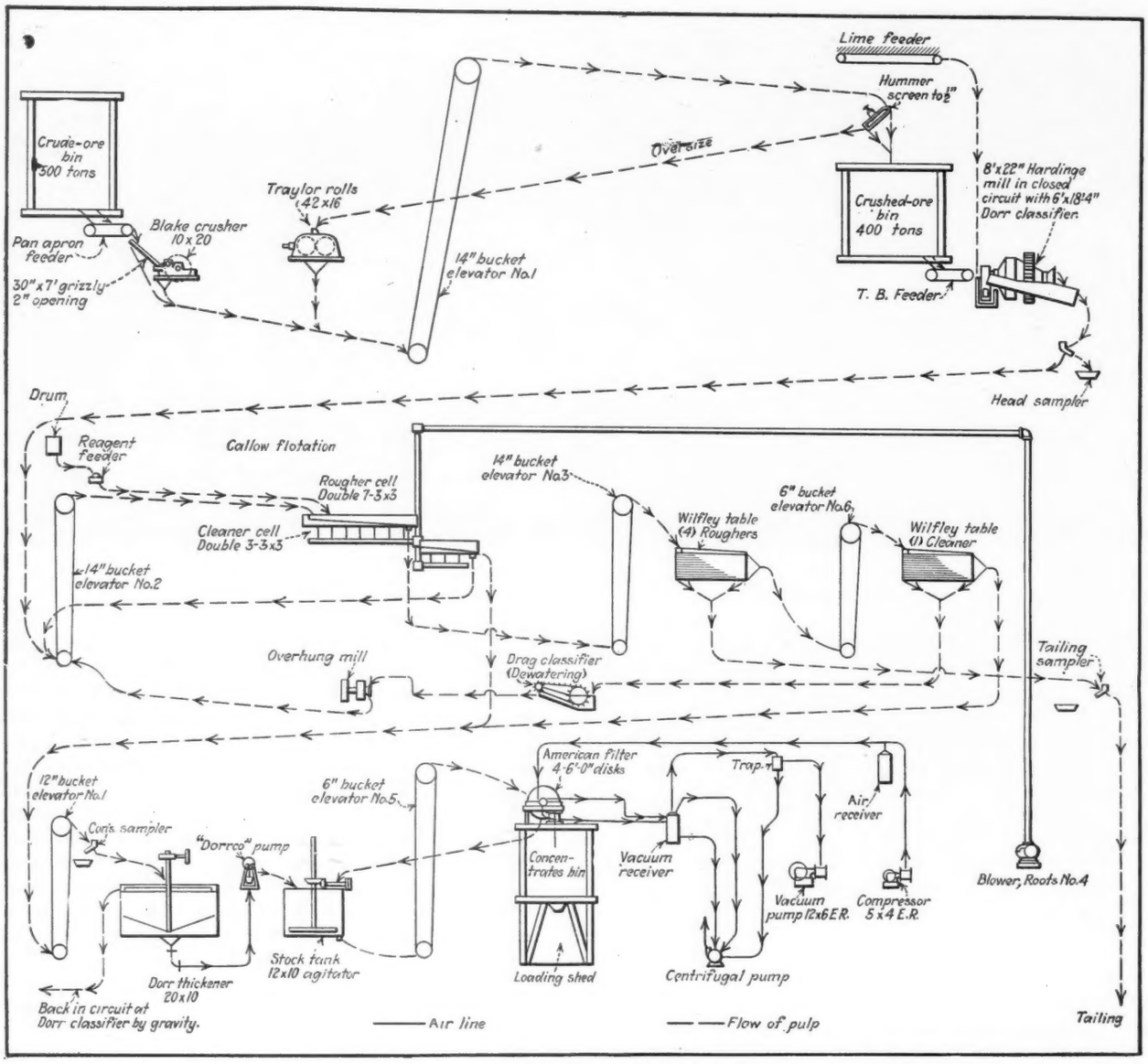
A brand-new mill or factory has something fascinating about it. The absence of dust and dirt, the sight of spick and span smoothly operating new machinery, and the odor of fresh timber combine to make it an attractive object—to an engineer, at any rate. So it is with the Talache mill, a compact modern flotation plant capable of easily handling 150 tons per day. It was designed by the General Engineering Co., of Salt Lake City, which acted as consulting metallurgical and construction engineers and supervised the construction of the mill. The company did everything to expedite its erection and operation that it agreed to do. The pleasant relations existing between mine management and the consulting metallurgical engineers, and the fact that the mill was built quite within its estimated cost, speak well for this arrangement. Some favorable purchases of machinery in a declining market and the ability to purchase lumber and other supplies locally helped to lower the estimated total outlay. The mill represents an investment of close to $120,000.

The mill is constructed of wood, with corrugated galvanized-iron sides and roof. Two accompanying photographs show its outward appearance. Although advantage could have been taken of a hillside location for the mill, a flat site was chosen as being preferable. This arrangement gives a very compact plant, in which all machinery is readily and quickly accessible and under the supervision of two men at the most. It would not be difficult in a pinch for one man to look after the entire plant. A small amount of climbing is all that is necessary to visit any section of the mill. Bucket elevators have had to be used to convey the pulp from one unit to another, but their cost of operation is low and is offset by the important advantage of compactness. Ease of construction and the elimination of heavy grading costs are other advantages gained by construction on a level area. With the exception of filter, all operating equipment can be supervised from one working floor. The mill contains only one more bucket elevator than if it had been built on a hillside site. An additional advantage of the present location is the nearness of the mill to the mine portal and the greater compactness of the camp in general. These factors make for greater ease in supervising operations as a whole.

The ore is delivered to the mill in 2½-ton cars drawn by a storage-battery locomotive and dumped in a crude-ore bin having a capacity of 500 tons. From an ore-bin chute the ore drops to a Stephens-Adamson apron feeder and then to a 30-in. grizzly set to 1½ in. leading to a Traylor jaw crusher 10x20 in. The undersize of the grizzly and the product from the jaw crusher are elevated in a 14-in. bucket elevator (No. 1) to a Hummer screen sizing to ½ in. and discharging directly into a crushed-ore bin of 400 tons' capacity. The oversize of the vibrating screen is passed through Traylor rolls 42x16 in., set to ½ in., and discharging into bucket elevator No. 1. Thus all the crushed ore is reduced in fineness to a minimum of ½ in.

Callow Flotation Equipment Used

Secondary crushing is done with an 8-ft. Hardinge mill operating in closed circuit with a 6x18½-ft. Dorr duplex classifier and fed by a belt feeder from the crushed-ore bin. The Hardinge mill is driven by a Link Belt silent chain drive and 125-hp. motor. It grinds to minus-80 mesh. Lime is added at this point, as flotation takes place in an alkaline solution with reagents the names of which I am not at liberty to state. Steam is discharged into the Dorr classifier to bring the pulp



Flow sheet of 150-ton flotation mill

temperature between 60 and 70 deg. F. The discharge of the Dorr classifier passes to bucket elevator No. 2 and is delivered into the first Callow rougher cells, consisting of seven double compartments. The concentrate from the rougher cells drops to the cleaner cells of three double compartments. Tailing of the cleaner cells flows back to bucket elevator No. 2. The tailing of the rougher cells goes to bucket elevator No. 3, by which it is transferred to four Wilfley roughing tables making two products, a tailing passing out of the mill and concentrate lifted by bucket elevator No. 6 to one Wilfley cleaner. This table also makes two products, a tailing to be discarded and concentrate joining that from the Callow cleaner cells and passing to bucket elevator No. 4, which feeds a 20x10-ft. Dorr thickener. The overflow of the thickener is returned to the mill circuit at the Dorr classifier. The underflow is pumped by a diaphragm pump to a 12x10-ft. mechanical agitator that discharges to bucket elevator No. 6, leading to a four-disk American continuous filter with 6-ft. disks. The filter cake drops into a concentrate bin which is directly over a loading shed where motor trucks can be conveniently loaded. A Roots blower No. 4 supplies air at 3½ lb. pressure to the flotation cells and a small 5x4-in. air compressor and 12x6-in. vacuum pump serve the filter.

An accompanying flow sheet shows the relations of the units described and the flow of the pulp through the mill. Electric power is supplied by the Washington Water Power Co., but purchased from the Mountain States Power Co. The company built and owns 10.5 miles of 11,500-v. transmission line, with suitable transformer stations at each terminal. At the Sandpoint end, the voltage is stepped down from 66,000 to 11,500 v. and at the mine end from 11,500 to 2,300 and 440 v. A local power house contains 20-hp. and 100-hp. boilers and is the central heating plant. It also houses a 1,320 cu.ft. per minute direct-connected synchronous motor-driven air compressor.

Although the concentrating plant has been in operation only since March 1, 1922, results have more than come up to expectations. It is endeavored to keep heads at 15 oz. silver, but there are periods when they naturally run below and above that grade. A

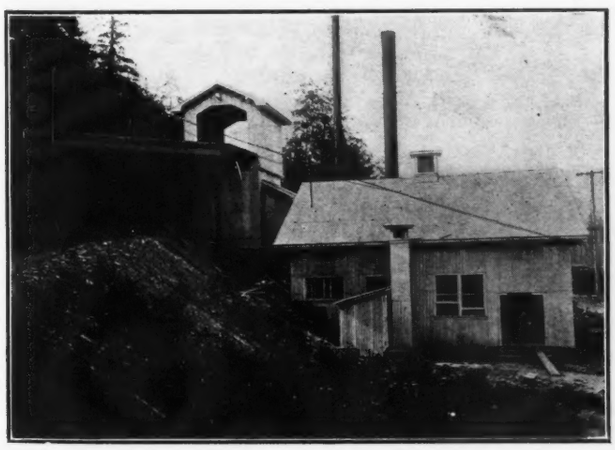
A staff cottage

typical assay of heads for one month this spring was 13.86 oz. silver, 0.069 oz. gold, 0.58 per cent copper, 0.79 per cent lead, 2.00 per cent zinc, 8.00 per cent iron, 0.75 per cent manganese and 75 per cent "insoluble." Average recovery for the months of March, April, and May was 93.8 per cent of the gold, 94.3 per cent silver, 98 per cent copper, 86 per cent lead and 15 per cent zinc. The concentrate in the first fifteen cars shipped ran 0.707 oz. gold, 152 oz. silver, 6 per cent copper, 7.21 per cent lead, 3.12 per cent zinc, 30.49 per cent iron, 1.5 per cent manganese, and 8.8 per cent "insoluble." The concentrate is now being shipped to the Tacoma smelter of the American Smelting & Refining Co.

Prior to July 1, the mill was operating on two shifts and handling 95 to 96 tons in fifteen hours, but is now running on three shifts. Over 160 tons have been treated without difficulty. Concentrate is running close to 200 oz. For the last sixteen days in July the mill treated 163 tons of ore per day, with the following result:

	Au	Ag	Pb	Cu	"Ins"	Fe	Mn	Zn
Feed	0.065	16.92	0.72	0.67	74.4	7.0	2.9	2.9
Tailing	0.005	1.00	0.08	0.02	76.3	4.5	2.8	2.8
Concentrate	0.66	190.0	7.3	6.55	9.3	28.6	1.0	3.5
Recovery, per cent	93.0	94.5	89.9	97.6	....	....	....	...

In July the mill treated an average of 155 tons per day at a cost of 93c. per ton. Tests have been made to determine the capacity of the mill. During the first fifteen days of August 180 tons per day was treated, with results corresponding to those given above. On one or two days the mill was operated at the rate of 200 tons per day, and the management is confident it can successfully treat this daily tonnage. The larger tonnage was obtained mainly by decreasing the mesh of the Hum-mer screen. Recovery fell 1 per cent and less.



The mine boiler room and compressor plant

At present, additional housing facilities are being provided. When this construction work is completed the company will be able to employ the additional miners required to mine 200 tons per day. New stopes are now being opened and extensive development is under way. By the end of October the company expects to be operating on a basis of 200 tons per day.

Not only the mechanical equipment of the Talache mines but also the accommodations for the miners and their families are in keeping with the attractive appearance of the camp. Single miners are given rooms in the company hotel, which contains 44 rooms, two men to a room, single beds, electric lights, steam heat, and hot and cold running water. The men are supplied with bedding, showers, and means of recreation. Charges are $5 per month per man. Two rows of charming small cottages have been built for the men with families. It is not difficult to observe that the management believes in having a contented force of co-workers and has done more than has been called for in providing pleasant

Employees' cottages near the mill

homes for the community. Everything considered, location, technical equipment, and conditions of work, mining at Talache may well stand for the ideal small mine and its community.

The mine is owned by A. H. Burroughs, Jr., and associates. Mr. Burroughs is vice-president and manager of the company. I am greatly indebted to him for permitting me to visit his operations and for furnishing me with many data regarding his plant.

If there is any lesson to be learned, or if there are conclusions to be drawn, from an inspection of the work at Talache it is the fact that a few men have taken a small, unspectacular silver vein, have painstakingly worked out its geology, developed it, provided working capital, built a mill to treat its ore, and have done so successfully despite the abnormally high costs of the last few years. I do not doubt that there are other Talaches in the western United States, but none so beautifully situated. The prospector who is dismayed and discouraged at statements inferring that the mineral wealth of the United States has all been discovered and that the large exploration companies have thoroughly combed the country may well take heart at this example of intelligent mining and careful planning to make the most of economic conditions. Unfortunately, a year and a half will probably witness the end of the purchases of dollar silver under the Pittman Act, but the principle holds. The small mine still has a chance when properly handled.

The Sundt-Diaz Flotation Machine

Similar to the Callow and Inspiration Type but with 1:4 Slope, and 60 Ft. Long—In Use at Corocoro in Bolivia

By F. A. Sundt

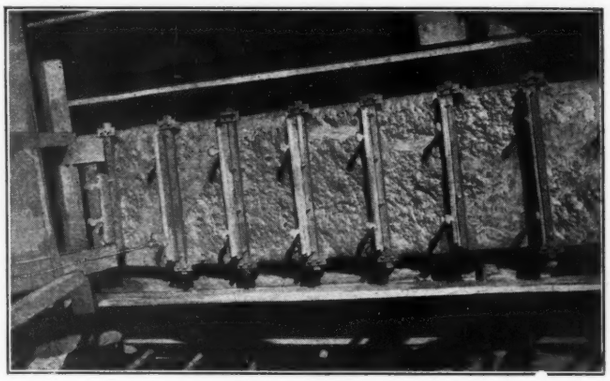
A PNEUMATIC flotation machine, like the Callow and the Inspiration type, but with some important differences, has been developed at the Corocoro mill. It is 4 ft. wide and 60 ft. long, with an inclination of the bottom of 25 per cent, or 1 to 4. The depth is the same —2 ft.—throughout the entire length. As can be seen in the photograph, the machine has baffles, these being 2 ft. apart.

Each cell of the machine has its own water level, these levels being varied by raising or lowering the baffles. No particular water level is generally necessary as each cell works by itself, the inflation of the canvas bottom after several days in operation being sufficient to prevent the froth from passing through the narrow opening between the canvas and the bottom of the baffles. Only in the last cell is a definite water level necessary, because of the tailing outlet.

At the middle of the machine is an electric motor with vertical shaft on which an impeller is mounted to aid in the production of froth by mechanical agitation. A longer machine might require more impellers.

This machine has a capacity of 500 metric tons in 24 hours and takes up less floor space and head room than others. If it were not for the baffles it would not be possible to use so long a machine and the same water level would exist throughout the length. This would result in at least 15 ft. of water at the tailing end, necessitating a more powerful blower and, of course, more power and expense. Because of the steep slope of the bottom, it is not necessary, as in the Inspiration type, to clean the canvas with water pressure. Each cell has an air pipe with valve, the pipe entering the machine at the side and not at the bottom as is customary in other machines. The canvas is purchased in New York, is used in four or five plies without sewing, and lasts four months.

This machine, which has been developed by the superintendent of our mill, Pedro E. Diaz D., and myself, is home-made and works as well as the Minerals Separation sub-aeration type, one of which we have here, and with less power and at lower cost.



The machine in operation

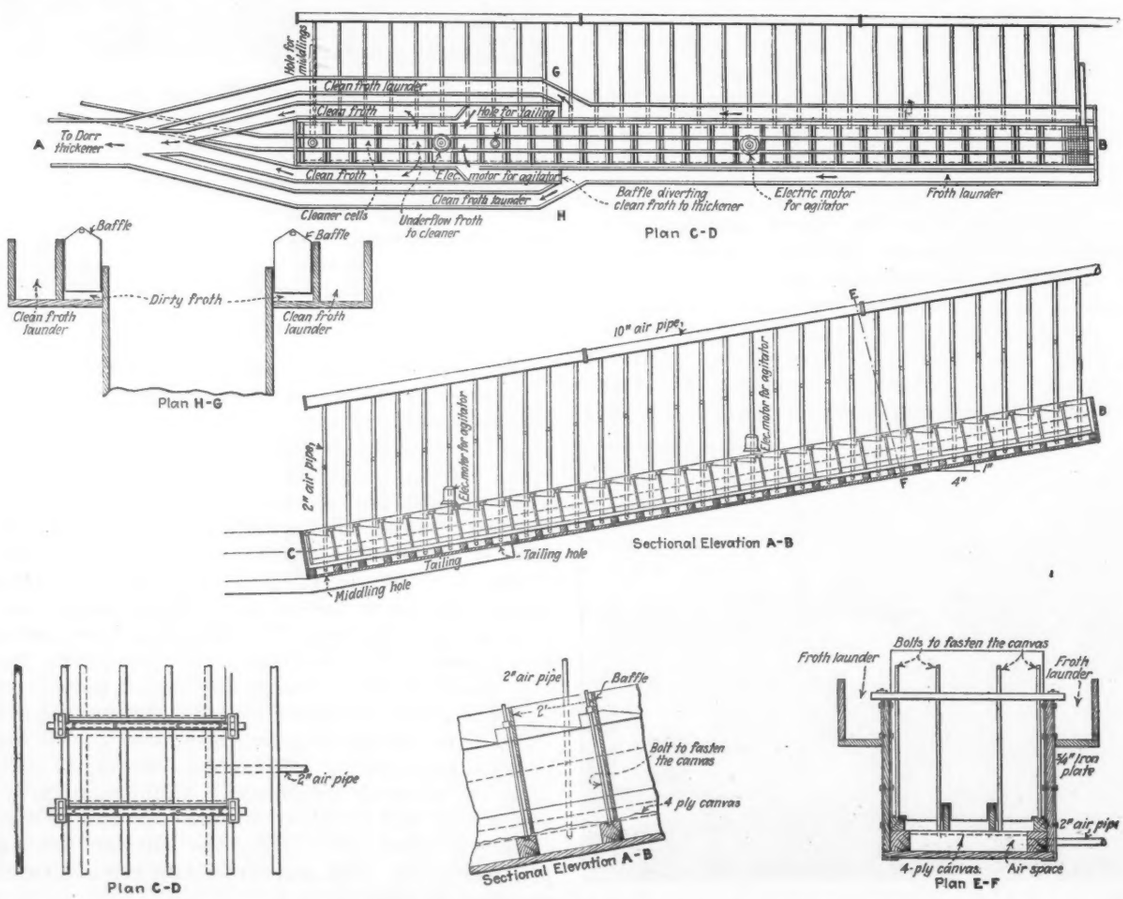


Diagram showing construction details of the Sundt-Diaz machine

Mexican Labor-Contract, Day's Pay, and Task

Contracts Advocated Only When Speed Is Not Necessary and Competent Supervision Is Unavailable—Task Best Suited to Tramming and Mucking—Management of Mexican Labor Requires Tact If Proper Results Are to Be Expected

BY W. W. SHELBY

SOME recent development work in the Sierra Mojada district of Coahuila, Mexico, affords an excellent comparison between the contract and day's pay system. About 1900 a shaft was sunk 46 m. to the igneous sedimentary contact, and one drift was driven from the shaft. The results were negative, and all work was abandoned.

In 1921 it was planned to sink the shaft and develop at depth. The shaft is 6 x 11 ft. The rock is limestone of average hardness. No air was available for the work.

The custom in this district has been to contract everything possible. Speed was one of the controlling factors, and previous shaft work by hand had given such small advances that a modified form of contract was decided upon. One round of eighteen holes was drilled and blasted each day and six men were used to drill the round. Each man drilled three holes, making a total of 3 m. per man, the time of drilling being eight hours. Table I shows results obtained.

TABLE I—PROGRESS AND COST, SHAFT SINKING IN COAHUILA, MEXICO

1921	Advance in Meters	Cost per Meter in Mexican Currency (Pesos) Drilling	Explosives	Mucking	Boss	Total
Sept. 3- 9	5.05	21.21	17.45	4.40	4.97	48.03
Sept. 10-16	4.40	19.92	15.08	6.36	4.07	45.43
Sept. 17-23	5.25	20.21	15.27	6.16	3.98	45.62
Sept. 24-30	4.30	20.59	15.58	7.03	4.15	47.35
Oct. 1- 7	4.20	21.21	15.80	7.51	2.53	47.05
Oct. 8-14	5.40	19.48	14.35	6.32	3.33	43.48
Oct. 15-21	5.50	19.47	13.06	6.20	3.71	42.44
Weekly Average..	4.88	20.27	15.16	6.23	3.82	45.48

Drilling was done for 1 peso per meter of hole drilled. Each man earned 3 pesos per day, or 50 per cent more than day's pay wage. Dynamite cost 1.12 pesos per kilo, caps 5 centavos each and fuse 3.00 pesos per 100 ft. These supplies are, of course, much cheaper now.

A Mexican contractor would probably not have advanced over one-half of this distance, and the cost is believed to be less than could have been obtained by contract. The reasons advanced for this discrepancy, are: A complete round was blasted each day, which would not have been accomplished by a contractor; no effort was made to place holes in such a way as to take advantage of the breaks in the limestone, and in drilling by the meter an incentive is offered for extra effort.

All miners were required to stay in the shaft until the entire round was completed. It was found that only the best single jackers could complete the round in the allotted time. A blueprint of the shaft round was furnished the Mexican boss, who dropped the plumb lines and measured off the holes according to the dimensions given. He was also given a clinometer with which to determine the proper angle on the cut holes, so that the pointing of holes was reduced to a mathematical basis and not left to the discretion of the shift boss.

From the bottom of this shaft a crosscut, 6 ft. wide by 7 ft. high, was run to the north in limestone which is similar to that in the shaft. The 6-ft. width was carried to accommodate three drillers at the face. Single-hammer work was attempted, at first, but the back holes proved slow drilling, and it was found necessary to resort to double-hammer work in order to complete the round in the eight-hour shift. When driving by single jacking 1 peso was paid per meter of hole drilled, and 30 cm. extra was allowed for the back holes. When changed to double-hammer work the *tarea*, or task system, was used. Each pair drilled 3½ m. for the day's work. Hence cost per meter of hole drilled was 1.14 pesos, as against 1 peso in the shaft. Upon the completion of their *tarea* each pair was allowed to leave their work, and this was a great inducement from their point of view, for they preferred this fixed daily task at a lower wage to single-jacking with its increased remuneration.

The results obtained in the crosscut are shown in Table II.

TABLE II—PROGRESS AND COST, CROSSCUTTING IN COAHUILA, MEXICO

1921–1922	Advance in Meters	Costs per Meter in Mexican Currency (Pesos) Drilling	Explosives	Mucking	Boss	Total
Oct. 22-Oct. 28	4.60	17.07	8.16	4.18	4.43	33.84
Oct. 29-Nov. 4	5.30	16.65	10.81	5.17	5.70	38.33
Nov. 5-Nov. 11	4.30	14.29	8.64	2.99	3.35	29.27
Nov. 12-Nov. 18	2.70	13.50	7.23	4.54	3.26	28.53
Nov. 19-Nov. 25	4.70	14.47	9.11	4.00	2.77	30.35
Nov. 26-Dec. 2	4.40	15.45	10.10	4.83	2.32	32.70
Dec. 3-Dec. 9	5.80	7.59	3.98	3.75	1.98	17.30
Dec. 10-Dec. 16	3.70	11.35	3.81	3.11	2.30	20.57
Dec. 17-Dec. 23	4.50	11.55	6.62	3.73	1.76	23.66
Dec. 24-Dec. 30	4.50	15.11	8.70	2.42	1.34	27.57
Dec. 31-Jan. 6	5.00	11.20	8.12	2.58	1.13	23.03
Jan. 7-Jan. 13	4.00	18.00	11.11	3.84	1.27	34.22
Jan. 14-Jan. 20	4.10	17.56	11.50	4.76	1.24	35.36
Jan. 21-Jan. 27	4.50	16.00	9.78	4.33	1.13	31.34
Jan. 28-Feb. 3	5.50	12.73	6.83	3.12	.93	23.61
Feb. 4-Feb. 10	4.80	15.00	9.27	3.91	.88	29.06
Feb. 11-Feb. 17	4.20	17.62	10.75	4.37	1.21	33.95
Feb. 18-Feb. 24	4.20	14.29	8.82	3.45	1.01	27.57
Weekly average....	4.38	14.23	8.42	3.80	2.02	28.47

Dynamite cost 1.12 pesos per kilo; fuse, 2 pesos per 100 ft., and caps, 5 centavos each.

The cost of mucking is more for a crosscut of these dimensions, but speed by hand drilling can be obtained only by completing the round in one shift. In this instance also the holes were spotted according to the dimensions on the blueprint. The angle of cut holes was rarely changed and little was left to the discretion of the boss. A nine-hole round was found quite satisfactory and consisted of 3 cut holes, 3 breast holes and 3 back holes.

It is obvious that the miner drilling by task or per meter of hole will take no care in the pointing of his holes. Hence, for a large number of workings the cost of supervision in pointing all holes would be prohibitive, unless speed were the paramount consideration.

As the workings increased in number they were all put on contract. In average limestone, such as covered by the above tables, it was found that the speed dropped to 40 per cent, while the cost increased only 3 per cent. The contractor reduced size of crosscut, worked fewer men, and blasted whatever holes he could finish at the end of the shift.

In another instance, a drift was driven along a fracture. This drift was largely pick work, assisted by two or three holes, and the work was done on day's pay with an advance of 3 m. per week, the cost amounting to 8 pesos per meter. The same men doing the work on contract, at the previous cost price to the company, averaged 7½ m. per week. Day's pay in this drift was a decided failure. Many more instances could be cited, but they would practically all lead to the same conclusions as those mentioned.

Supervision, as applying to those who are handling the details of operation, such as the shift boss and the mine foreman, is a subject upon which widely different views are held. Some maintain that close foreign supervision is the only method, whereas others hold that all orders should be issued by the Mexican boss, and some believe in a combination of the two. There are some excellent miners among the Mexicans, and, so far as ability to handle underground details is concerned, there will be no difficulty in finding the man. But to find the native boss who can get a day's work out of a day's-pay peon is much more difficult. The peon will not do the work for his fellow citizen that he will perform for the foreign boss, assuming that the latter understands Mexican labor.

The matter of cost is also a consideration. About three native bosses can be obtained for the price of one American boss. In my opinion, this increased cost is more than offset by the output per man shift. An active shift boss can efficiently handle a large amount of detail, stope bosses being necessary only when large orebodies are being extensively mined.

As to the type of foreign shift bosses, there are many and various. Before the Mexican revolution the most favored policy was "treat 'em rough." It was the practice to yell and swear at the peon. There are many bosses that still follow the same policy. In places it can still be done, and in places it cannot be done. But at no place will such a policy produce maximum results, and most companies will not permit it.

It sometimes seems that more tact is necessary to handle the peon than is required with higher class labor. They are easily led, but driven with more difficulty. Properly handled, they are cheap labor. Improperly handled, they lose their chief advantage—that of cheapness.

For development by hand, when speed is essential, carry large headings and use the task or drill by the meter. Use contract only when efficient supervision is not available and speed is not necessary. For stoping, whether by hand or air, drill by the meter. For tramming, use task or contract. Never tram by day's pay with Mexican labor. For mucking, use the task. For odd jobs, use the task whenever practicable. Do not use day's pay if either of the other methods can be applied. Have ample supervision of the proper kind.

Zinc Blende Roasted Without Fuel

Roasting of zinc sulphide ores without extraneous fuel is reported to have been highly successful in a new type of furnace installed about two years ago at the plant of the National Zinc Separating Co., Cuba City, Wis. Details of the furnace construction have not yet been released for publication. It is understood, however, that a company has been formed to introduce the new furnace and that Leslie H. Webb, 615 Union Arcade, Pittsburgh, has general charge of the work.

Underground Workers Must Have Good Drinking Water

A recent report by R. R. Sayers, chief surgeon for the U. S. Bureau of Mines, discusses the requirements for safe methods of supplying drinking water for men working underground. The recommendations are summarized as follows:

1. Water for drinking should be obtained from a source known to be pure. To be assured that it is pure, it is advisable to have the water or the sources of water examined and approved by the State Department of Health.

2. Where the water is known to be infected or its purity is unknown, it may be made safe for drinking purposes by distillation, by boiling, or by chlorination, under the proper superivision.

3. Small filters of the household type are not usually satisfactory and their use is, therefore, not advised.

4. The piping of drinking water underground is the safest method of its distribution.

5. If containers, such as barrels or kegs, are used in taking water underground, they should be kept tightly closed with only a tap or drinking fountain head, or both, for withdrawing the water. Such containers should be washed thoroughly and disinfected at regular intervals, at least once each week.

6. Sanitary drinking fountains should be so designed that it is impossible for the mouth of the drinker to come in contact with the outlet. Those fountains which direct the jet of water at an angle with the vertical are usually most satisfactory.

7. Taking drinking water underground in individual pails usually has the disadvantage of the water being obtained from many sources, often of unknown purity, but it has the advantage of decreasing the danger of transmission of disease through drinking water, as each miner generally drinks only from his own pail.

8. Where ice is used for cooling water, it should be made from distilled water or water from a source approved by the State Department of Health. In cooling the water the ice and water need not be in contact, in which case the purity of the ice is, of course, of less importance.

Blasting at Chuquicamata

Mining at the Chile Exploration Co.'s property at Chuquicamata, Chile, is an illustration of rock being broken on perhaps a vaster scale than in any other part of the world, says *The Excavating Engineer*. Previously the method employed was the tunnel method. These tunnels were driven parallel to the working bench; entrance to them was by means of shafts and crosscuts, the distance between the drilling tunnels depending upon the height of the orebody. The tunnels are 6½ ft. high and 5 ft. broad. Extensive tests are now being carried out to determine whether the churn-drilling method is more satisfactory. The holes are driven on an average of 16 ft. apart and 55 ft. deep. It has been found that this method of blasting breaks up the ground well and has resulted in higher shovel output.

Trojan and Du Pont dynamite is used, seven to eleven cases to a hole. Extensive use is made of jackhammer drills driven from a central compressor station for the purpose of breaking up rocks that are too large to go through the crushers.

Pyritic Smelting at the Siemens-Kwarzchana Copper Works, in the Caucasus

Plant a Modern One, Consisting of Sintering Pots, Blast Furnaces, Converters, and Refining Furnace—Metallurgical Results Good and Costs Low, Though Operation Has Been Spasmodic Because of War Conditions

BY DR. C. OFFERHAUS
Consulting Engineer, Beer, Sondheimer & Co.,
Frankfort-on-Main, Germany

THE CLASSIC KEDABEG copper mines (the oldest copper mines and copper-smelting works in the Caucasus, having been worked since 1864), being nearly exhausted, the Siemens company decided in 1912 to build a new smelter to smelt the ore of their Kwarzchana mines, which they bought about twenty years ago.

The Kwarzchana property is at present situated on Turkish territory, at the right border of the Tschoroch River, at a distance of about 70 versts[1] from Batoum and about 20 versts from Artwin. From the village of Sinkot, on the Batoum-Artwin government road, a private road of about 5 versts, with grades up to 12 per cent, goes up to the mines, which lie at an altitude of about 800 m. The property had been developed since 1904, and the company did not decide until the fall of 1912 to build a smelter; by that time about 18 km. of tunnels had been driven and about 30,000,000 poods[2] of ore with about 5 per cent copper was in sight.

The ore occurs as a lens-shaped orebody of massive copper-containing pyrite, formed by metasomatic replacement at a contact of a lime-alumina schist at one side and rejuvenated andesite and tuff, called quartzite, at the other side.

The following average percentage analyses of a large quantity of run-of-mine ore shows the composition of the ore, with its striking high arsenic content:

	Cu	S	Fe	Zn	Pb	Bi	As	SiO_2	CaO
"A" ore.....	7.1	42.25	34.65	3.67	0.72	0.01	1.46	3.54	0.2
"B" ore.....	4.65	44.58	37.16	2.87	0.52	0.015	1.24	3.1	0.2

As may be seen from the analysis, the ore is suitable for pyritic smelting; however, in consequence of its

[1] 1 verst = 1.07 km. = ⅔ mile.

[2] 1 pood = 16.38 kg. = 36 lb.

Fig. 1. General view of the country about the smelter

high arsenic content, not for the manufacture of sulphuric acid.

The quartzite which covers the orebody contains up to 80 per cent SiO_2 and has the following composition:

	SiO_2	Al_2O_3	FeO	CaO
Per cent	78	8.5	3.85	1.2

Parts of this, rich in silica, are, lacking a richer and purer quartz, used as flux for the pyritic smelting.

The foot wall, a lime-alumina schist, is locally disseminated with copper-containing pyrite. Of this copper-containing schist with 2 to 7 per cent copper, about 20,000,000 poods have been developed since 1915; considering the theory of the genesis of the orebody and by analogy with other orebodies of the same kind, still larger quantities of this copper-containing schist may

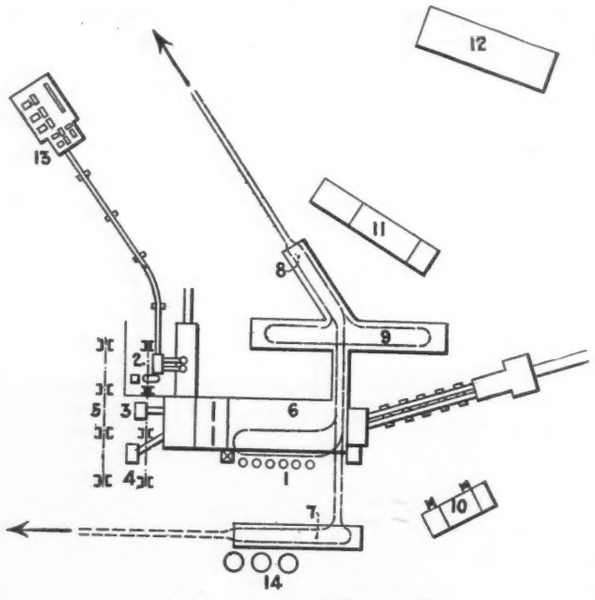


Fig. 2. Plan of the smelter

be expected. An average analysis of a large quantity of this material shows the following composition:

	Cu	S	Fe	SiO_2	CaO	Al_2O_3
Per cent	4	6	17.0	38.9	2.4	20.3

The material is of course not suitable for pyritic smelting, and must be concentrated in any event.

Transportation Conditions Not Good

The problem of how to work this orebody in a profitable way depended very much upon the transportation problem. Transport conditions are poor. No reliance could be placed on the railroad projected for many years between Batoum and Artwin. The Tschoroch is a wild unregulated river, and continuously changes its bed, which is very wide in parts. Only small boats (so-called *kajooks*) with a capacity of about 100 poods can be used; they serve to bring people and freight down the river (at about 15 km. an hour) and must then be towed up again, which is very troublesome. A special powerful motor towboat with flat bottom and screw propellers was planned and prepared by the Siemens company to use for this purpose, but on account of the war the service was postponed. An aërial ropeway from the mines to Batoum was projected, but was not built, as the costs were too high. Transportation from and to the mines therefore must be done by auto trucks or horse wagons, and the cost of transportation from Batoum to Sinkot was 30 kop.[a] per pood, before the war, not including back freight.

All possibilities of working the property with a profit were carefully studied. However, the conditions of transportation governed, and made necessary the erection of a smelter near the mines to smelt the ore pyritically. In this way the costs of transportation were reduced to a minimum (coke, crude oil and warehouse supplies up and copper down), and the transportation up and down was about equal. Though there is a market for sulphuric acid in the Caucasus and the south of Russia (Baku and Grossny), the recovery of sulphur was not planned; also, the iron, which before the war was not paid for when present in purple ore, goes to waste with the slag. Moreover, one must calculate upon a loss of about 12 per cent of the copper with the slag. Flotation was planned for the treatment of the copper-pyrite-containing schist; however, the erection of the flotation plant was delayed by the war. It may be mentioned here, that massive pyrite ores of this kind can be worked more economically by roasting, making sulphuric acid, and then chloridizing, roasting, and leaching. In this way a higher recovery of the copper (about 95 per cent) is reached, and the sulphur and iron are not lost. In out-of-the-way places, however, one is compelled to smelt the ore at the mines and to pass up the less valuable components such as sulphur and iron. High-sulphur ores have in such a case the special advantage that pyritic smelting is possible, so that part of the sulphur can be used as fuel to replace coke.

Situation of the Smelting Works

For the erection of the smelting plant, a level spot in a valley enlargement formed by a mountain "slip" was chosen. The building of the plant was started in the last months of 1913; when the war started, the work was practically stopped. On Nov. 5, 1914, Kwarzchana was taken by the Turks, but they were driven out of the country in the spring of 1915. In July, 1915, the plant started operation and worked with several interruptions on account of lack of labor, coke, crude oil, and supplies, up to January, 1918. In this month operations had to be stopped because of the political and economic conditions. The highest monthly production was over 17,000 poods of copper. The operation of the plant showed that the works were able (in normal times) to make a profit and it was planned to start operations again as soon as local conditions allowed.

The general situation of the works is shown in the photograph, Fig. 1, and the plan in Fig. 2. The sintering plant (1), blast furnace (2), converter (3) and refining furnace (4) with crane (5) are situated around a large dust chamber (6). Both stations of the aërial ropeway (7 and 8) which connects the plant with the mines and the government road (Sinkot), the bins for ore, quartz and coke (9), the sintering plant, laboratory (10), shops (11), and warehouse (12), lie on the same level as the dust chamber and the charging floor of the blast furnace. The tapping floor is about 6½ m. lower, and the level of the converter, refining furnace, and crane columns is about 9 m. lower. The power and blower house (13) is a distance of about 100 m. from the blast furnace, and somewhat lower—on the converter and refining-furnace level. The three storage tanks for oil at the side of the ropeway station are built on a somewhat lower level, the upper rims of the

[a] One ruble = 100 kop. = $0.50.

tanks corresponding with the working platform of the station.

The power plant and blower house are built under one roof and are provided with three vertical Diesel engines made by Gebr. Sulzer, Winterthur, Switzerland (4 cylinder; model 4-D 65; 190 r.p.m.; capacity 265 hp. each), directly coupled with three S. S. W. d.c. generators (capacity 185 kw.; 190 r.p.m.; 525 v.) and two Enke positive blowers (No. 9, with a total capacity of 300 to 350 cu.m. per min. and a pressure of 2,000 to 2,300 mm. of water; 250 to 290 r.p.m.; power total 216 to 250 hp.). The blowers are directly coupled and stand on the same foundation plate with two S. S. W. d.c. shunted-circuit motors of 140 hp. each (525/550 volt, 200 to 300 r.p.m.), with starting rheostat and shunted-circuit regulator.

Other equipment includes a Brown-Boveri turbo-blower with a capacity of 170 cu.m. per min.; 2,930 to 3,030 r.p.m.; pressure, 0.95 to 1.05 atmospheres; 315 to 345 hp.; direct coupled and on the same foundation plate with a 400 hp. S. S. W. d.c. motor of 3,000 r.p.m., with starting rheostat and shunted-circuit regulator; a small special motor for remote control of the turbo-blower from the converter stand; a small 15-kw. transformer for lighting the buildings. Outside the buildings, series arc lights are used. It should be noticed that direct current was chosen, this being specially adapted for works equipped mainly with blowers, elevators and cranes.

If the plant works full capacity the daily oil consumption is 160 to 180 poods. The price of the oil in January, 1916, was Rbl. 1.25, free works, and the cost of 1 kw.-hr. was 4.2 kop.

Two Aërial Ropeways Provided

The ropeway from the mines to the smelter has a fall of 73 m. on a horizontal length of 600 m. The contents of a wagon is about 200 liters (about 20 poods of ore) and about 60 cars can be moved in one hour. Power used is 1½ to 3 hp. and the motor provided is of 7 hp.

The ropeway from the smelter to the government road has a fall of 426 m. and a horizontal length of 1,970 m. The cars take 10 poods, and 24 cars can be shipped in one hour. The power used is about 12 hp. and a 20-hp. motor is provided. The aërial ropeways were built by the J. Pohlig A.-G. in Coeln-Zollstock.

The Fuel Supply

Baku crude oil (sp. gr. 0.875; 11,000 cal.) reaches Batoum in railroad tank cars and is pumped into large oil tanks on the Siemens grounds in Batoum. Auto tank cars and horse-driven tank wagons take the oil to Sinkot, where it is stored in an oil tank with a capacity of 30,000 poods. Later on an agreement was made with the Caucasus Copper Co., which works a large copper property in Dsansul, in the Murgul Valley, about 20 versts from Bortscha at the left border of the Tschoroch River, to pump the oil for Kwarzchana through their 4-in. pipe line from Batoum to their pump station near Bortscha, into a storage tank of the Siemens company. Oil transportation by truck was then reduced to about 20 versts. From Sinkot the oil is transported to the smelter by the ropeway in special ropeway barrels, which take 10 poods of oil. At the ropeway station of the smelter the barrels are emptied by means of funnel and pipe into the three oil tanks mentioned, of 10,000 poods each. From these tanks a pipe goes to the power house with a side line to the refining furnace. At both places of consumption the oil can be measured.

Coke and anthracite are also brought to Sinkot with auto trucks and horse wagons; the materials are weighed in Batoum and Sinkot and stored in large storage bins in Sinkot, from which place they are transported to the smelter by means of the ropeway. At the plant, the ropeway cars filled with coke (about 10 poods each) are led over the coke bins and are emptied therein.

The Ore and Flux Supply

The ore cars at the mines, leaving the main tunnel, are discharged on an inclined grizzly; the material which passes the grizzly falls on another inclined grizzly, which makes a 90-deg. angle with the first one. In this way the ore is classified in three sizes and slides down on the inclined bottoms of the storage bins. The ore is generally much decomposed by the weather and large lumps can be broken easily with a hammer; the erection of a crusher was therefore not necessary.

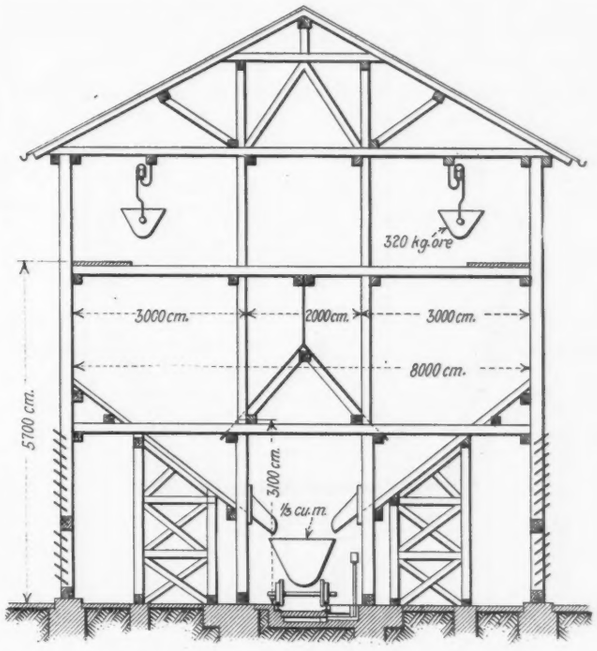


Fig. 3. Cross section of ore bins

A high-grade quartzite can be mined in an open-cut not far from the ore bins, and about 50 m. above them. This material is carried down by means of a double-acting inclined railway, passes a No. 4 Humboldt crusher with a jaw opening of 250 x 125 mm., and slopes down to the quartz bin, which stands on the same level as the ore bin. A rail of the ropeway passes alongside the ore and the quartz bin; the full cars are pulled by hand to the near-by ropeway station and pass there over an automatic scale. The counted and weighed cars go by ropeway down to the smelter. Lump ore and quartz are there dumped in the storage bins, and the fine goes directly to the sinter plant. The cost of the ore, f.o.b. smelter, was, in the last month of 1915 and the first month of 1916, 6 to 8 kop. per pood.

The storage bins stand on the level of the charging floor of the blast furnace and directly at the side of the lower ropeway station. Fig. 3 represents a schematic cut through a compartment of the ore bin. The

bins are built of wood and covered with a roof; all sliding planes are covered with 3-mm. sheet iron. The dead space of the bin is generally filled with ore; this ore can be taken out, if necessary, by hand from the bottom by removing the side boards. The bins are designed to hold fourteen days' supply of ore and quartz. For materials which come from Batoum, as coke and oil, the storage capacity in Sinkot and at the plant together suffices for three to six months, as transportation in winter time is occasionally interrupted for months by snow.

The water conditions are not very favorable. One-third of the water of a near-by stream is at the disposal of the plant; it is dammed about 50 m. above the plant and runs through a 6-in. pipe line to the plant. About half way, a water tank with a diameter of 15 archin[1] and a height of 7 archin is placed. The mountains in this part of the country are much decomposed by weathering, and steep; during the rainy periods much turbid water comes down and during the rest of the time water is scarce, though the plant has never had to be shut down because of this. The blast-furnace jacket water is all reclaimed. Even in times of water scarcity, it was al-

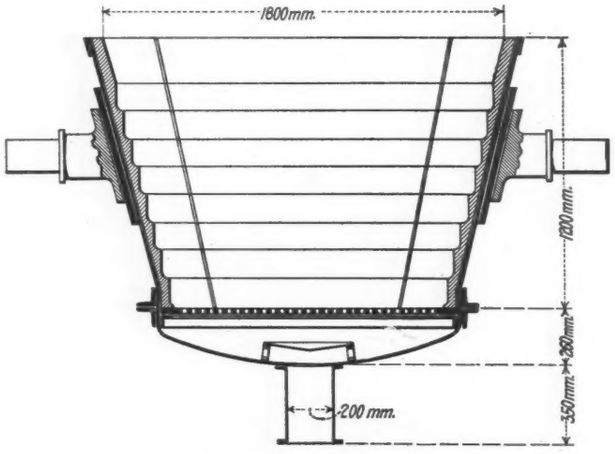


Fig. 4. Cross section of sintering pot

ways possible to granulate two-thirds of the slag; at such times slag was handled one-third of the time with 5-metric-ton slag cars, and in this time the water tank mentioned above was filled.

Sheet-Iron Sintering Pots Not Desirable

The sintering plant was furnished by the "Maschinenbau-Anstalt Humboldt," Coeln-Kalk, and designed for a capacity of 60 metric tons in 24 hours, which was obtained on an average. There are six stationary pots with a capacity of 2.2 cu.m. each, which stand along one of the long sides of the dust chamber. The construction of these pots can be seen from Fig. 4. The pots are not of the usual cast-iron construction, but are of boiler sheet iron with a ribbed cast-iron lining consisting of four parts. This construction was chosen as it was expected to have certain advantages for remote places (no risk of bursting and easy to transport). It did not, however, come up to expectations, as the pots warp more or less from the heat, causing the axes to become deflected, this making the dumping difficult. In increasing the plant, cast-iron pots are planned again, the bursting being no longer so serious, with the possibility of electric welding. The air connection, with stuffing box and flexible steel tube, is regulated from the platform by means of a lever; the dumping is done by means of a hand wheel. The air blast is furnished by a blower (high-pressure ventilator) with a capacity of 150 cu.m. per min. at a pressure of 1,000 mm. of water (diameter of propeller, 700 mm., 3,150 r.p.m.; 45 hp.), directly coupled with an S. S. W. d.c. motor of 50 hp. and 2,750 to 3,450 r.p.m.

The grates of the pots are covered, as is usual, with a layer of limestone. Waste wood serves to ignite. A rail of the ropeway runs from the lower ropeway station over storage bins, bridge, and dust chamber, along the six pots. The cars with fine ore are dumped on a wooden platform, built on the dust chamber; the different kinds of ore are then mixed, moistened, if necessary, and the mixture is charged in small quantities into the hoppers or through the doors in the hood of the pots. The charge is divided over the surface, stopping the holes. As soon as a charge is burnt through, a new one is dumped, and as the pot fills, the air valve, which in the beginning is nearly closed, must be opened. At the end of the operation the air pressure is 350 to, exceptionally, 600 mm. The running of the sintering plant is very simple and easy. The duration of a charge is 9 to 20 hours, depending upon the composition and other qualities of the fines, some of which do not sinter easily. It will be necessary to increase the capacity of this part of the plant, the mines making more than the expected one-third fines which must be sintered. The sinter blocks are broken up by hand with a hammer, and the material goes directly into the charging cars for the blast furnace, or is stored in the neighborhood of the pots. The fines go back to the mixing platform on the dust chamber by means of an elevator. The cost of sintering in 1915 and 1916 was 5.5 to 6 kop. per pood, this depending upon the material to be sintered.

Blast Furnace Operation

The blast furnace (M. A. Humboldt in Coeln-Kalk) measures 3,000 x 1,100 mm. at the tuyères. The furnace has twenty tuyères, ten on each long side, with a diameter of 120 mm., which can be reduced to 100 and 80 mm., and three tiers of water jackets. The distance from the tuyère level to the charging floor is 5.45 m. The construction of the furnace can be seen from Fig. 5. The bottom is water-cooled by tubes cast into the bottom plate. At both short sides of the furnace there is a water-cooled syphon spout, having on the inside a copper sheet and a separately cooled nose of bronze. Both tapping jackets are of solid copper with water-cooled tubes cast inside. The connections between bustle pipe and tuyères are of flexible steel tubing; the tubes connecting the main water pipe with the water jackets are also of the same material. These flexible steel tubes gave satisfaction here, as well for air as for water. The furnace has two downtakes, which together have about the same diameter as the cross-sectional area of the furnace. The charging doors of the furnace top are counterbalanced and open to the inside of the furnace; they close automatically.

The charge cars take about ½ cu.m. Part of the empty cars coming from the furnace go to the sintering plant to take sinter and then run underneath the storage bins to pick up revert (matte and slag); others run directly underneath the storage bins to take ore and quartz. A charge consists of four cars of ore and quartz, which are equally divided between the four

[1] 1 archin = 0.711 m.

doors, and two cars of sinter, divided between both sides of the furnace. The coke for each charge is dumped on the charge floor in front of the furnace, shoveled in by hand, and equally divided over the surface. Examples for a normal charge are the following, the figures being given in poods: A.—Ore, 125; sinter, 45; quartz 20 to 24; coke, 4. B.—Ore, 125; sinter, 36; quartz, 20 to 24; coke, 4; and slag, 14. The furnace is generally kept filled, but this depends upon the condition of the furnace and also upon the kind of the ore—for example, on its size. Normally, the air pressure, measured at the blower, is 2,200 to 2,400 mm. water (300 r.p.m., 245 hp.). It is very easy to keep the tuyères open; generally they show some fire in the center of the furnace. The furnace puts through about 330 metric tons of total charge in 24 hours, 110 metric tons per sq.m., and concentrates ore with 4.8 per cent of copper in one smelting operation, to matte with 35 to 40 per cent of copper, using about 2.3 per cent of coke.

A trial was made to replace the coke by so-called anthracite from Thwibul (24.8 per cent volatile matter and 1.2 per cent ash), which at the time could be secured much easier than coke. However, economical advantage did not result, as with the same furnace conditions about 15 to 20 per cent more anthracite than coke was necessary, which might be explained by the volatile matter being driven off before reaching the burning zone of the furnace. Moreover, this anthracite contained about 10 to 12 per cent fine that had to be screened out. The difference in price was not great enough to justify the difficult work in using it, in case sufficient coke is available (the price of 1 pood coke f.o.b. plant was 1.22 rubles in April, 1916, and of 1 pood anthracite 1 ruble).

A trial was also made of adding to the furnace charge the schist ore mentioned before. This caused, as might be expected, a much higher coal consumption, and a simple calculation showed concentration to be advisable. As mentioned before, it is planned to treat this by flotation.

Matte and slag leave the furnace through a 6-in. slag hole in the copper tapping jacket, by the syphon spout, which, as stated, has a copper sheet on the inside and is lined with magnesite bricks. A spout of cast steel did not prove to be a success; a syphon spout of cast copper, with cooling tubes inside, was tried and gave satisfaction. The large settler is lined with firebrick; only at the tap hole are magnesite bricks used. The settler is cooled on the outside by a water spray. The slag flows from the large settler into a small one, the last one collecting some matte. As it leaves the spout of the small settler the slag is cut and granulated by a water stream leaving a 3-in. tube flattened at the mouth, and is carried through a wooden launder (400 x 400 mm.) lined with sheet iron up to the water level, to the dump down the valley. Experience showed that it will be advisable to use a still larger settler; so the large settler, 2,000 x 5,600 x 1,450 mm. high, will be replaced by one 6,220 x 2,775 x 1,300 mm. high (dimensions of shell); in this way it is expected to get a slag lower in copper. Matte is tapped by a 2-in. tap hole into a matte launder of sheet iron (400 mm. wide and 350 mm. high) lined with firebrick and clayed, into a three-ton cast-steel ladle. The ladle is suspended from a seven-ton overhead traveling crane, with a width of 11 m. (lift about 7.5 m.; auxiliary lift, 3 tons). The filled ladle is taken to the converter and emptied therein. If too much matte accumulates in the settler and if the converter cannot take any more the matte is tapped on the floor. After being cooled off this matte is broken up and serves to cool hot-running converter charges, or if much is on hand, it goes back to the furnace charge.

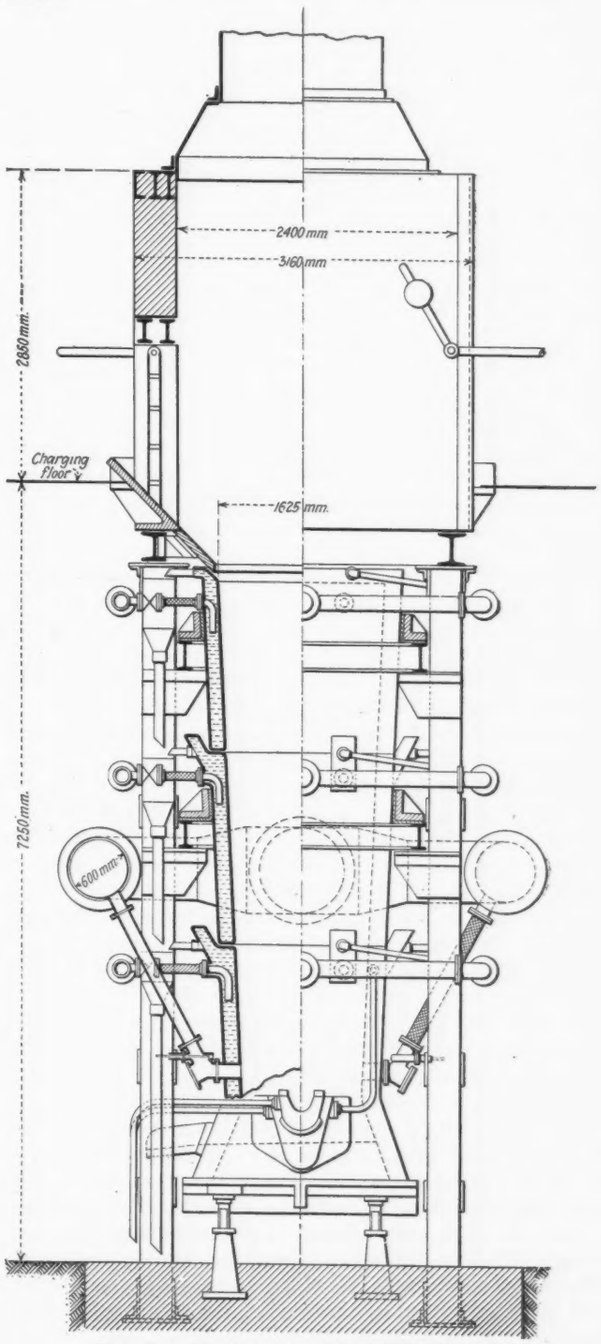


Fig. 5. Design of copper blast furnace

The following table gives the monthly average analyses of slag and matte for 1915 and 1916; they show a remarkable uniformity:

MONTHLY AVERAGE ANALYSES, IN PER CENT.

	Slag					Matte
1915	SiO_2	FeO	CaO	Al_2O_3	Cu	Cu
September	31.6	49.9	2.7	9.8	0.42	40.0
October	29.9	52.6	2.4	9.0	0.46	35.0
November	30.9	50.8	2.6	8.8	0.42	35.0
December	32.7	51.3	2.3	8.7	0.47	40.0
1916						
January	31.5	52.6	2.4	9.2	0.44	37.0
February	34.2	50.4	2.3	9.8	0.32	35.0
March	31.1	52.8	2.5	6.5	0.29	30.0

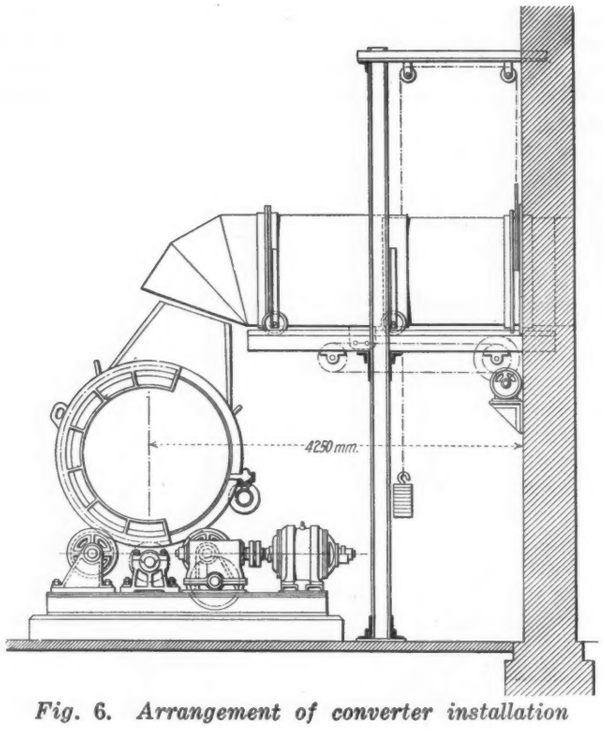


Fig. 6. Arrangement of converter installation

As mentioned before, in Kwarzchana, in one smelting operation a matte with 32 to 40 per cent copper is made, which goes directly to the converter. It was found that it was not advisable to effect a higher concentration in the blast furnace, the slag then getting too rich. Moreover, with a higher-grade matte the furnace puts through less and the slow irregular running makes the operation more difficult. At this place it may be mentioned that the construction of the furnace and the amount and pressure of the air have a marked influence on the results which are achieved in pyritic smelting. The Société Metallurgique et Industrelle de Caucase, for example, which runs a copper smelter at Allah Verdi on the Tiflis-Kars Railroad, has 4.2 per cent copper and 27 per cent sulphur on the ore charge (Kwarzchana only 20.4 per cent sulphur) and nevertheless had the experience that with its conditions of furnace and air pressure[5] it is necessary to resmelt the matte, which means a considerable loss in coke, time, labor, and furnace capacity. There are plants, as for instance at Copperhill, Tenn.,[6] where it is of advantage to concentrate twice in the blast furnace, as the ores are poor and the coke is not so very expensive and hard to get, so that the making of a low copper slag outweighs the cost of coke, labor, and the loss of time. There even limestone is added to make the slag light and poor. For out-of-the-way places like Kwarzchana, concentration by smelting twice does not pay.

The running of the furnace in Kwarzchana is, for pyrite smelting, very easy and regular. Blowouts were nearly all caused by lack of ore, coke, oil, labor, or cars. The cleaning out of the furnace and starting up again does not take much more than twenty-four hours. The following are the results of the blast furnace smelting for December, 1915, expressed in poods:

Ore	Sinter	Matte	Slag	Quartz	Total	Coke and Anthracite
233,366	91,446	30,262	11,883	56,375	423,332	9,706
Days Working		Copper Produced			Per Cent Fuel	
21		11,168			2.2	

[5]*E. & M. J.*, April 10, 1915, p. 651.
[6]Offerhaus: *Metall u. Erz.*, 1913, Heft 27.

The converter plant has one stand with two five-ton barrel converters with basic lining (see Fig. 6). The traveling crane is not strong enough to change the converter barrels, which does not occur so often with basic lining, and for this purpose a hydraulic car on rails is used; this has a capacity of 35 to 45 tons (platform, 1,600 x 1,700 mm.; pressure, 30 atm. with hand pump; plunger, 270 mm.). The converter is tilted electrically by a 10-hp. S. S. W. d.c. motor (500 r.p.m.; gearing 1:1,200). The converter hood is mounted on a car and movable horizontally; this construction allows taking off the gases in every position of the converter and has the advantage that movable parts do not come in contact with the flame and hot gases. The running of the converter may be seen from the following daily reports:

Charge No.	Matte Time	Charged Poods	Flux: Quartz	Flux: Limestone	Slagging	Charge Finished	Copper in Matte
107	8:20	300	30	20	9:00	....	....
...	9:15	150	30	..	10:00	....	....
...	10:30	150	45	20	11:20	....	....
...	11:30	150	45	15	12:40	....	....
...	1:00	150	45	.	1:30	....	....
...	2:25	150	45	..	2:00	....	....
		1,050	240	55	3:20	5:40	39%
108	8:15	300	30	60	9:15	....	....
...	9:30	150	30	15	10:40	....	....
...	10:30	150	30	20	11:40	....	....
...	12:00	150	30	..	1:40	....	....
...	1:50	150	30	..	2:20	4:40	40.5%
		900	150	95			

The empty converter receives about 30 poods of quartz, which is poured in by the crane by means of a sheet-iron bucket, and thereupon two ladles of matte. After a blow of about three-quarters of an hour the slag is poured off and again quartz and matte is poured in, and so on. Cold matte is charged if the converter runs too hot. The first charge mentioned shows that the last ladle matte was poured in at 2:25. At 3:20 the last slag was tapped and there was enough white metal to start the second blowing period. At 5:40 the charge was ready.

The slag is tapped in a flat cast-steel ladle (see Fig. 7) which stands on the floor before the converter and is transported by the crane to the large blast-furnace settler and poured therein. It could not be observed that the slag running from the settler becomes temporarily richer by pouring in this hot, heavy, and rich slag (about 2 per cent copper and 70 per cent iron);

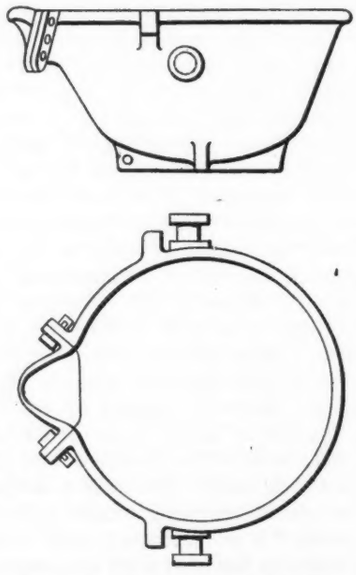


Fig. 7. Cast-steel slag ladle

on the contrary, the overflowing slag is temporarily poorer, which was also observed at other plants and which may be explained in this way—that the heavy converter slag takes the suspended matte particles down. Pouring the fluid converter slag into the settler is, in pyritic smelting, the best way to dispose of the basic converter slag, which is of no value to the furnace as flux.

The converter copper is poured into a ladle which has a slag shell; the ladle is taken up by the crane, conveyed to the refining furnace and its contents poured therein through the front door by means of a movable runner. If the refining furnace is not in position to take converter copper, it is poured, by means of a runner attached to the converter, in cast-iron molds of about 5 poods, mounted on a car which runs on rails underneath the converter. The bars of converter copper are later on charged to the refining furnace. As is seen from the daily converter report, the converter takes about 2,000 poods of matte of about 40 per cent copper in nine hours. The air pressure is regulated at the converter stand by long distance; the pressure at the converter is 0.575 to 0.625 atm.; the diameter of the tuyères is 1¼ in. At the start, two converter linings were ruined before their time by unskilled labor. The third lining made (up to the time that the plant was closed, January, 1918) 75,000 poods of copper without repairing and was still in good condition. This result was probably mainly due to the fact that a progressive premium was granted for the amount of copper which was blown with one magnesite lining.

The refining furnace takes seven tons of charge and is fired by crude oil. The hearth and sides of the furnace up to the level of the bath are of magnesite brick. An overhead brick flue takes the furnace gases the shortest way to an antechamber of the large dust chamber. The refining furnace report, below, corresponds with both converter charges given above and shows that a charge of about 400 poods is refined in five to six hours with an oil consumption of 7 to 10 per cent. It should be mentioned that the copper is charged in fluid condition and that during the period of oxidation air is blown into the bath; furthermore, that the condition of the copper charged (more or less overblown) has also some influence on the duration of the charge. The refined copper is cast into anodes (350 x 600 x 28 mm.), which weigh about 2½ poods, and goes to Moscow to the electrolytic refinery. The anode copper contains about 1,250 grams of silver per metric ton, and about 30 grams of gold.

REFINING FURNACE REPORT JANUARY, 1918

Charged	Ladled			Oil Consumption
Time	Time	No. of Anodes	Poods	Poods
4:45	9:30	151	375.5	30.5
6:20	11:20	163	403	31.5

As mentioned before, all working parts of the plant are arranged around a large dust chamber. This dust chamber is built out of natural stone (limestone) with cement mortar. The roof is of concrete and on the inside painted with an acid-proof paint. The dust chamber consists of two large divisions parallel connected and several antechambers (see Fig. 8), which have a total length of 52 m., a width of 15 m. and a height of 7 m. The antechambers have hoppers which make it possible to take out separately most of the dust from the blast furnaces, converter and refining furnace during the running of the plant. The balance of the dust, which condenses in the main dust chamber, is in such small quantity and contains so little copper that this main dust chamber needs cleaning but once a year. Behind the dust chamber are two balloon flues of sheet iron about 37 m. long and 2 m. in diameter, which are supposed to cool the gases to condense the arsenic trioxide. At the end of the balloon flue is an installation for artificial draft consisting of two exhausters with a capacity of 600 cu.m. per min. each (propeller diameter, 2,000 mm.; 750 r.p.m.; pressure, 75 mm. water; 15.5 hp.) directly coupled with 2 S. S. W. d.-c. motors of 20 hp. each. This installation (see Fig. 8) is built in such a way that both exhausters can be stopped and put out of the circuit if not needed. Behind the artificial draft installation, the flue, with a cross section of 2 x 2 m. and a length of about 600 m., takes the gases up the hill and to a height of about 300 m. above the level of the plant, though the stack is only a few meters high. This flue is also built of stone with cement mortar; the roof is of concrete and arched with T-beams as arch supports. Artificial draft is used so long as the system is cold and gives good service during the starting up of the blast furnace. Also it is indispensable in starting up the whole plant, when only the sintering plant is running. As soon as the system is warmed up, the artificial draft can be put out of circuit. The slide in the main flue is opened, the extension tubes at the suction and pressure openings of the exhaustors are removed, and the holes in the brickwork closed, so that the exhaustors are no more exposed to the fumes. As mentioned before, and as can be imagined, the draft conditions are as good as they can be, and the men on the charging floor of the blast furnace and also in the sintering plant are not at all hindered by the fumes. The balloon-shaped flues have fulfilled their duty and came up to expectations, as behind these flues, under the exhaustors, and in the main flue up to 5 to 10 m. up the hill, dust is condensed with 45 to 60 per cent arsenious oxide, the dust condensed in the large dust chamber being practically free from that compound. It is planned to erect directly behind the artificial suction installation, a dust chamber for the arsenic dust, in which the flue of the planned arsenic-refining furnace with its condensation chamber will be laid. The insertion of a Cottrell apparatus in the existing system was planned, but had to be postponed because of the war.

The copper recovery was, on the average, 89.75 per cent. The production costs of one pood of copper anodes in December, 1915, when the plant was running twenty-one days, may be of interest, as at that time the wages and prices for materials were not yet so high. These costs may be compared with the costs before the war and may therefore show the commercial feasibility of the enterprise in normal times.

The following table gives the wages and prices of materials in rbl. per pood during 1914, December, 1915, and April, 1916:

WAGES AND PRICES OF MATERIALS

Wages	1914		Dec., 1915		April, 1916	
Mines						
Foremen	Rbl. 1.40 to 1.70	12 hr.	Rbl. 1.70 to 2.20	12 hr.	.....	
Miners	Rbl. 1.20 to 1.50		Rbl. 1.50 to 2.00		.....	
Helpers	Rbl. 0.60 to 0.80		Rbl. 1.20 to 1.50		.....	
Smelter						
Foremen	.....	8 hr	Rbl. 3.00 to 3.30	8 hr	.....	8 hr.
Laborers	Rbl. 0.90		Rbl. 1.50 to 1.80		Rbl. 1.70	
Mechanics	Rbl. 1.75 to 1.80		Rbl. 2.20 to 2.50		Rbl. 3.00	
Carpenters	Rbl. 1.75 to 1.80		Rbl. 1.80 to 2.20		.....	
Bricklayers	.....		Rbl. 2.50 to 3.00		Rbl. 3.50	
Materials (f.o.b. smelter) Rbl. per pood						
Coke	.....		Rbl. 1.02		Rbl. 1.22	
Anthracite	.....		Rbl. 0.90		Rbl. 1.00	
Crude Oil	.....		Rbl. 0.99		Rbl. 1.25	
Iron	Rbl. 1.60 to 1.80		Rbl. 2.60 to 2.80		Rbl. 6.50 (Baku)	
Planks (5 x 1 Werschock width and thickness; 6 archin long) Ral. 1			Rbl. 1.25			
Steel	.....				20.00 (Batoum)	

The production cost of 1 pood of anode copper with about 1,250 grams silver and 30 grams gold per metric ton, in 1915-1916, delivered at Batoum, was as follows:

	Rbl.
Sintering	0.25
Blast-furnace smelting	2.04
Converting	0.47
Refining	0.38
General expense	1.66
25 poods of ore f.o.b. smelter	2.00
Amortization and interest	3.50
Transport to Batoum	0.30
Total	10.60

Taking in consideration that the anode copper contains gold and silver and the fact that at that time wages and materials were already higher than in 1914; furthermore, that the price of the anode copper in Russia before the war was Rbl. 12 to 13 per pood (in 1915-16, Rbl. 30 to 40 per pood), it may be seen that the enterprise is certainly a paying one under normal conditions. In 1916, though there were, as said before, many difficulties and only 90,000 poods of anode copper could be made, though the plant was utilized only about half the time and had to stand the normal amortization for the full year, a considerable surplus was gained. And even in 1917, during which the situation got worse and worse so that in January, 1918, the plant had to be stopped, a small profit was made.

After the plant had been closed for nearly three years, it seemed in the fall of 1920 to be possible to start operations again under protection of the Georgian Republic, to whom the territory around Batoum belonged at that time. In October, 1920, preparations for regular work were started. In the last weeks of December everything was in shape and the furnace was blown in. However, the production during January and February, 1921, was only 4,600 poods, this being mainly because of the difficulties in transport, caused by much snow and lack of benzene for the auto trucks. There was constant friction between the bolshevist government of Azerbaijan and the Georgian Republic, and as a result the Georgian Republic got no oil products. On the twelfth of March, 1921, Batoum was occupied by the Russian bolshevists, and the plant, lying in territory occupied by the Turkish (Kemalistish) Government, had to be shut down again, being cut off from its base (Batoum). The bolshevists not only did not allow the export of food, oil, coke, tools and other supplies out of Batoum, but also commandeered part of them, occupied the auto trucks of the company and created conditions under which it was impossible to run the plant. On Oct. 21, 1921, the treaty of Kars was closed between the three bolshevist republics in the Caucasus and the Turkish Angora Government, by which the territory around Artwin, Kwarzchana included, remained to Turkey, with free transit for all goods through Batoum. Since that time preparations have been made to start again, and if conditions do not change, the plant may be in full operation soon.

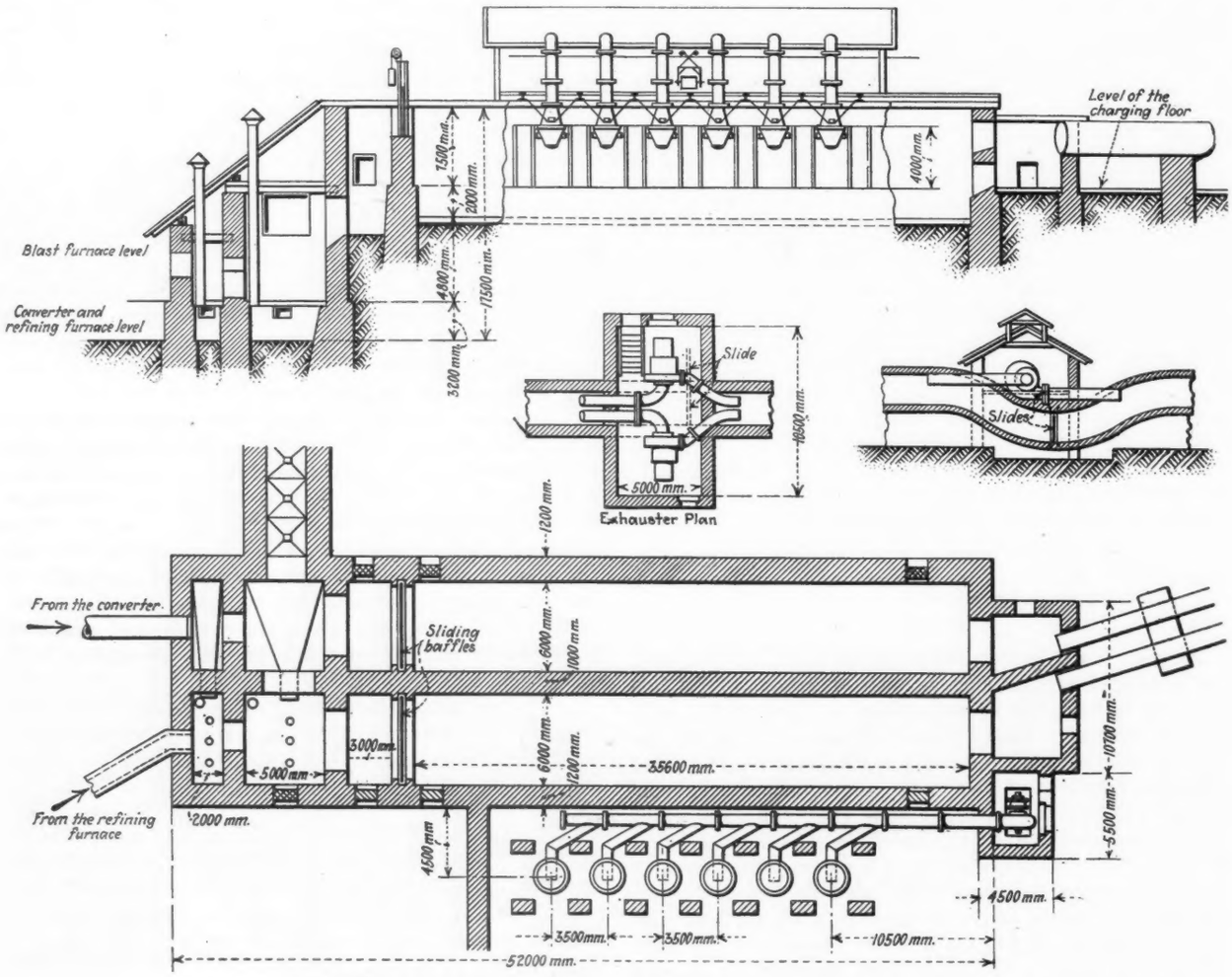
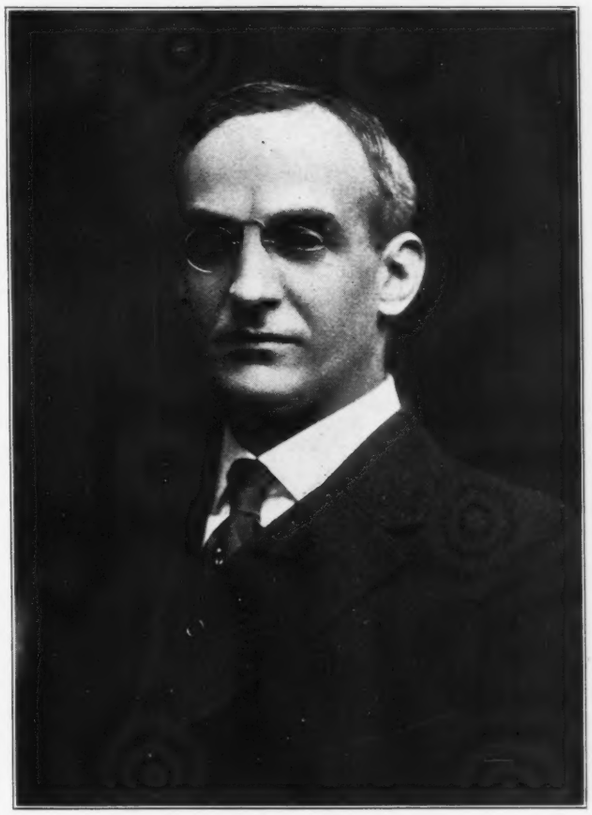


Fig. 8. Arrangement of flues and dust chambers

Mining Engineers of Note

MILNOR ROBERTS

MILNOR ROBERTS, dean of the College of Mines of the University of Washington, at Seattle, was born in New York City in 1877, the son of William Milnor Roberts, of Philadelphia, then chief engineer of the Northern Pacific Ry. and president of the American Society of Civil Engineers. As a child he lived for three years in Brazil, where his father was in charge of the engineering work being carried on by the government under Dom Pedro II. After returning to this country he lived near Philadelphia and then in Hartford. In 1890 he moved to Colorado Springs, where the great mining activities in Colorado aroused his interest. Cripple Creek, distant only a day's tramp from his home, was then just discovered; its development became familiar to him, and specimens of its ores were soon added to his collection of minerals and rocks. He staked some claims on his own account, but as (he admits) they did not make him independent, he has since been working for a living. Training gained in boyhood on the cattle plains and in the mining regions of the Rockies has stood him in good stead during later periods of mining exploration. His technical training, following two years of classics and science in Colorado, was obtained at Stanford University, his field work being directly under the late Dr. J. C. Branner. His vacations were devoted to mining work and geological studies. By the end of his college days he had gained experience in several Western states, Canada, and the Hawaiian Islands. After graduating in 1899 he continued his professional studies at Stanford for two years, at the same time serving as instructor in mineralogy. In 1901, when Alaska was booming, he went to the University of Washington and started to build up courses to serve the mining needs of the Pacific Northwest. He designed and built mining and metallurgical laboratories and a complete mill for ore testing. The College of Mines has now developed not only the usual courses but curricula in coal mining, electrometallurgy, and ceramic engineering. Research work by graduate students with the aid of fellowships is an important feature of the college, especially in co-operation with the U. S. Bureau of Mines, which in 1916 established its Northwest Experiment Station at the college. The growth of the University of Washington from 575 to 7,015 students in two decades has required much administrative work and continual planning of buildings and grounds, to which Dean Roberts' engineering knowledge has been applied. Professional examinations have occupied all of his vacation periods. He has spent a number of seasons in Alaska and also in British Columbia and various parts of the West. During three seasons in the North he carried on extensive drilling and mapping operations with the aid of some of his own graduates. During the war he was engaged as consulting engineer to the U. S. Bureau of Mines in hastening the production of war minerals in the Pacific Northwest, by reporting on recent discoveries, assisting producers, and testing ores for processes of treatment. He also served throughout the war on the Seattle War Savings Committee, as well as on special drives. He took part in the mining work of the Portland and Seattle expositions. He has testified as expert witness in important litigation in Goldfield, Nev., the Coeur d'Alene region of Idaho and elsewhere. He has served as consulting engineer to the State of Washington, the City of Seattle, and sundry power and railroad companies. In addition to preparing mining reports he has contributed articles to the mining and engineering societies, the mining periodicals, the *Journal of Geology*, and *National Geographic Magazine*. He is a member of the American Institute of Mining and Metallurgical Engineers, the Mining and Metallurgical Society of America, and the Pacific Northwest Society of Engineers, of which he is past president.



MILNOR ROBERTS

Dean Roberts, as he is widely known in the West, is the principal author and the editor of a number of bulletins on the mineral resources of the State of Washington. He belongs to several local clubs, is president of the City Land Co., and a member of the executive committee of the Alaska Bureau of the Seattle Chamber of Commerce.

THE PETROLEUM INDUSTRY

The Geologist Has Great Opportunity in Texas Oil Fields

Recent Discoveries in Eastland and Stephens Counties Indicate Area Is Not Exhausted

THE excitement of the oil producers in Eastland and Stephens counties, Tex., over the discovery of the Ranger and Caddo fields some years ago was followed by depression and gloom as it became apparent that these fields would be short-lived. Companies that had made great investments and prepared elaborate drilling programs had to sustain losses, some of them staggering. Optimism was followed by pessimism. First the operators could see nothing bad in the region; then they could see nothing good in it, says a member of the U. S. Geological Survey.

The pessimism was as shortsighted and as destructive of rational judgment as the unrestrained optimism. Operators who persistently stuck to the region and intelligently prospected and developed it found new pools and extended old ones. Obviously the region still has reserves of oil with which to repay those who can learn the secret of its hiding places and who, after finding them, are gifted with the intelligence to develop it rationally. Suicidal rentals, high lease prices, and huge royalties are becoming less and less common, and it is to be hoped that the paying sands of this district will soon be developed entirely as a business and not as pure speculation.

Geology has played its part in the discovery of the fields of central Texas, and will evidently be of high value in their future development, but the country is not one where the geologist can ride out in his car, glance over the landscape, squint at a rock through his magnifying glass, and indicate exactly the spot where a fortune is waiting for the drill to discover it. At least, if his work is done in that way it is likely to come to a painful end at the hands of the outraged operators whose "dusters" he has so simply and quickly located. This is a region where the geologist must spend weeks or months in the mesquite scrub, must spend long hours plotting and studying well records, must call upon fact and fancy—or at least scientific imagination—to enable him to visualize the conditions below ground, and must give deep thought to every recommendation that he makes, for the successful development of the region depends largely upon him. Fortunately, the geologist's work is gradually becoming easier with better prospects of success. At first very few geologic facts had been published concerning this region, and geologists working there were compelled to rely entirely upon their own observations. Even now, years after the discovery of the Ranger pool, published descriptions of the geology are scarce, and the newcomer in the field is badly handicapped. Even the U. S. Geological Survey has published comparatively little regarding this region—in fact, only two short bulletins, one on the Lacasa area, and another on the Wiles area, in Stephens County.

These bulletins discuss regions that are perhaps as fully developed as the cost of development and the selling price of oil will at present justify, but the facts they present are applicable to adjacent areas and will furnish a safe foundation for geologic work. Such a foundation is particularly needed by geologists who are new in the region and who have therefore not become acquainted with the conditions.

Argentine Petroleum Activities

The Territory of Neuquen, where the Argentine Government has been carrying on active exploitation of petroleum for some time past, is coming into prominence as a center of oil activities, says E. F. Feely, in *Commerce Reports*. Two American companies and the Argentine Astra Co. have wells in production in this field. The Anglo-Persian interests are also drilling in this region. The Chilean company, "Orion S. A.," has machinery and equipment on the ground and will begin drilling shortly. Several other Chilean companies are in process of organization to operate in Neuquen and Comodoro Rivadavia.

The official report of production from the Comodoro Rivadavia reserve for the first six months of the current year was 1,100,000 bbl., despite administrative difficulties and lack of storage and transportation facilities. The Astra Co. in Comodoro Rivadavia has a production of about 70,000 bbl. monthly from the last three wells brought in, and has exported two cargoes of crude oil to Germany and one to Italy in the past few months. A topping plant is in operation at Campana, and the company is now in a position to deliver 2,000 tons of fuel oil per month.

Slight Increase in Production of Crude—Imports Increase Also

The daily average gross crude oil production in the United States for week ended Sept. 16, according to estimates of the American Petroleum Institute, was 1,493,700 bbl., compared with 1,504,400 for the preceding week, a decrease of 10,700. Following are estimates, in barrels, of the daily average gross production for the weeks ended Sept. 16 and Sept. 9, 1922, and Sept. 17, 1921:

	1922		1921,
	Sept. 16	Sept. 9	Sept. 17
Oklahoma	400,600	402,700	307,500
Kansas	86,650	86,550	95,000
North Texas	54,250	52,400	65,450
Central Texas	144,600	147,600	99,900
North Louisiana and Arkansas	123,700	127,400	117,600
Gulf Coast	107,800	106,900	106,650
Eastern	113,000	113,000	113,500
Wyoming and Montana	78,100	82,850	48,300
California	385,000	385,000	323,000
Total	1,493,700	1,504,400	1,276,900

Imports of petroleum (crude and refined oils) at the principal United States ports for the week ended Sept. 16 totaled 1,861,051 bbl., a daily average of 265,864, compared with 1,765,124, a daily average of 252,161, for the week ended Sept. 9.

Technical Papers

Canadian Geological Survey—Parts "A" and "D" of the Summary Report, 1921, are now available from the Geological Survey, Canada Department of Mines, Ottawa. Part "A" contains articles on Silver-lead Deposits of Davidson Mountains, Mayo District, Yukon; the Upper Kitzault Valley, B. C.; the Coast and Islands of British Columbia between Burke and Douglas Channels; Copper Ore Deposit on Lasqueti Island, B. C.; Placer Mining in Barkerville Area, B. C.; Geology of the North Thompson Valley Map-area, B. C.; and the Lardeau Map-area, B. C.

Part "D" covers An Exploration of Thunder Bay, Ontario; Investigation of Peat Bogs in Ontario; Synopsis of Information Concerning the Peat Situation in Canada; Goudreau Gold Area, Michipicoten District, Ontario; Deroche, Hodgins, Gaudette, and Shields Townships, Algoma District, Ontario; Wanapitei Lake Map-area; Radium-bearing Pegmatites of Ontario; Geology of Lemieux Township, Gaspe County, Quebec; and Possibilities of Finding Oil or Natural Gas at Edmundston, New Brunswick.

Memoir 131, sixty-four pages, illustrated, and with maps, describes the Kenogami, Round, and Larder Lake Areas, Temiskaming District, Ontario.

Tellurium—U. S. Bureau of Mines Reports of Investigations No. 2,385 is a mimeographed three-page paper describing the history, properties, sources, uses, metallurgy, and qualitative and quantitative estimation of tellurium. It may be obtained on request from the Bureau, at Washington, D. C.

Canadian Department of Mines—The "Summary Report of the Mines Branch for 1920" has recently been published by the Canadian Department of Mines, Ottawa, as Bulletin No. 574, eighty-seven pages. It describes briefly the activities of the bureau during the year.

Mining Methods—In the *M. C. M. Alumnus* for June (Houghton, Mich.) is a short article by A. E. Redner entitled: "Sub-Level Caving Mining Method with Branch Raises." This paper describes some features of the branch-raise system now generally adopted on the Gogebic iron range.

Mineral Resources—Recent publications in the "Mineral Resources" series, obtainable from the U. S. Geological Survey, Washington, D. C., on request, include: "Barytes and Barium Products in 1921," ten pages; "Bauxite and Aluminum in 1921," eight pages; "Clay in 1921," six pages; "Feldspar in 1921," five pages; "Gypsum in 1921," eight pages; "Magnesite in 1921," six pages; "Mica in 1921," six pages; "Quicksilver in 1921," fourteen pages; "Salt, Bromine, and Calcium Chloride in 1921," nine pages; "Silver, Copper, Lead, and Zinc in the Central States in 1921," thirty-one pages; and "Tin in 1921," three pages.

Alloy Steels—Bulletin 199 of the U. S. Bureau of Mines, Washington, D. C., eighty-one pages, obtainable on request, is entitled "Experimental Production of Alloy Steels." It brings out some of the points considered in preparing the ingots and describes an indirect-arc furnace with a capacity of 100 lb. that was used in making the experiments.

Aluminum Castings—"Inclusions in Aluminum-Alloy Sand Castings" is the title of Technical Paper 290, twenty-five pages, obtainable on request from the U. S. Bureau of Mines, Washington, D. C.

Depletion of Mines—R. V. Norris has a ten-page article in the September *Bulletin* of the Canadian Institute of Mining and Metallurgy (603 Drummond Building, Montreal; 50c.) on this subject, in which he discusses the definition of depletion, methods of valuation, the discount rate, and methods of accounting.

New Books

Banka Tin. Published by the Dutch East Indian Government. Distributed gratis by American Metal Co., New York City.

This book has been written to familiarize the metal trades with Banka tin and to dissipate such prejudice as may exist against its use. It seems that users of Banka tin formerly experienced trouble in using the metal, as it occasionally caused explosions when a pig was added to a bath of molten tin. This was because of the old method of casting the pigs, permitting blowholes to be formed which allowed water to seep into the pigs. The present method of molding Banka tin has eliminated this effect.

The book gives a short popular description of tin mining in the Dutch East Indies, and the text is splendidly illustrated. Some general information regarding the world's tin production is included.

The D. & R. G. Route—Many of our readers who have had occasion to travel on the transcontinental railway lines of the country are familiar with the most interesting illustrated guide books which the U. S. Geological Survey has issued. Up to date the series has included "The Northern Pacific Route," "The Overland Route," "The Santa Fe Route," and "The Shasta Route." Now comes "The Denver & Rio Grande Western Route," as Bulletin 707, a book of 266 pages, beautifully illustrated and with the usual numerous and accurate colored topographic maps of the district along the way. The book is larger and better illustrated than the former ones and sells for $1 instead of 50c., as the others did. It may be obtained from the Superintendent of Documents, Washington, D. C.

Recent Patents

Jig—No. 1,420,975. Fred De Mier, Picher, Okla. A jig made up of several cells, screened bottoms, and a rake having a curvilinear movement, for each cell.

Concentrator—No. 1,421,264. Robert Le Roy, Basin, Mont. A new form of shaking table for concentrating ore.

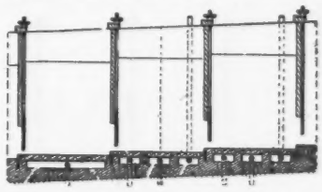
Centrifugal Flotation Machine—No. 1,420,138. W. H. Peck, Los Angeles. A rotating flotation cell in which the mineral is separated from the gangue by centrifugal action as well as by the action of rising air bubbles in an oiled pulp as is the common practice. Patent No. 1,420,139 covers the use of a similar machine for differential flotation.

Rotary Kiln—No. 1,415,990. A. B. Carstens, Monterey, Mexico, assignor to the American Metal Co., Ltd. A rotary kiln with openings on the sides to allow material to pass into the kiln, and also means for closing the openings to prevent the escape of gas.

Flotation Agent—No. 1,415,899. R. E. Sayre, Pittsburgh, Pa., assignor to Metals Recovery Co., New York. A composite flotation agent made up of a frothing agent and thiourea compounds produced therein by the combination of carbon bisulphide with analine and substituted analine.

Conical Mill Operation—Canadian patent No. 221,879. H. W. Hardinge, New York City. The classifying action in the conical part of a dry-grinding Hardinge mill is augmented by introducing a pipe in the feed trunnion and directing a spray of an "elastic fluid" (presumably air) on the material being ground; or the air may be blown or sucked through the mill as a whole.

Pneumatic Flotation Machine—No. 1,415,105. D. D. Moffat, Hayden, Ariz. A flotation machine made up of cells as



shown in the illustration, the floors of the cells being made porous for the admission of air.

Amalgamator—No. 1,412,673. O. A. Burgess, Puyallup, Wash. A rotary amalgamator made of perforated amalgamated plates, with means for turning it, delivering feed to the central portion, and supplying mercury.

Electrode — Canadian patent No. 222,089. U. C. Tainton, Martinez, Cal. A permeable electrode for the electrolytic precipitation of metals from their solutions, comprising a paper or fiber sheet in which is incorporated a ground conducting material. A metallic reinforcement sheet or another textile sheet may be added.

SOCIETIES, ADDRESSES, AND REPORTS

Who Produces Gold and Silver?

An Analysis of the Gold and Silver Production of the United States—The Origin of the Metals Based on Mine Output

By H. N. Lawrie

THE American Gold and Silver Institute has compiled an index of all corporations, partnerships and individuals actually producing or owning properties equipped to produce gold and silver. Many records were consulted and the resulting index was checked by the return of the Institute's index questionnaire and otherwise. It is a live list, comprising a total of 3,349 names, of which 2,464, or 73.6 per cent, are incorporated companies, 295 are partnerships and 590 are individuals. Many of the partnerships and individuals are those operating under lease and, consequently, do not require extensive capital. It is, therefore, evident that extensive capital is required to insure commercial success, since so large a number of corporations are engaged in the precious metal mining industry as compared with the number of partnerships and individuals.

With One-third of Producers, Gold and Silver Are Byproducts

Of the 2,464 incorporated companies engaged in producing gold and silver 1,678, or 68 per cent, produce principally gold, silver, or gold and silver, while 32 per cent produce gold and silver as a byproduct of base metals. Of the 295 partnerships, 266, or 90 per cent, produce the precious metals, either separately or in combination, while but 10 per cent produce the precious metals as byproducts of base metals. Of the 590 individuals producing gold and silver 85 per cent produce the precious metals alone, while but 15 per cent produce them as byproducts. This analysis indicates that extensive capital is not so essential in the production of gold and silver from siliceous as from complex base metal ores.

Of the 3,349 incorporated companies, partnerships and individuals engaged in the production of gold and silver, 73 per cent produce principally gold, silver, or gold and silver, while 18 per cent produce copper in combination with gold and silver and 9 per cent are engaged in the production of gold and silver with complex ores of lead and copper.

After reading the above segregation of gold and silver based upon the companies, partnerships and individuals engaged in the industry one naturally is led to inquire as to whether this result would be checked by analysis of the actual mine production figures compiled by the United States Geological Survey. That yearly fluctuations may be eliminated, the following analysis of the mine production figures for the decade 1909-1918 should provide a very accurate basis of comparison.

Origin of Gold and Silver Based on Mine Production

Of the total mine production of gold in the United States for this period—$900,000,000—66 per cent, or $594,000,000, was derived from siliceous ores; 25 per cent, or $225,000,000, from placer gravel; and 9 per cent, or $81,000,000, as a byproduct of base metal ores. About three-fourths of the byproduct gold, or $61,000,000, was derived from ore containing principally copper, while the remainder, or $20,000,000, was recovered from complex ores containing copper, lead and zinc in combination.

Of the total mine production of silver in the United States for the decade—$430,000,000—36 per cent, or $155,000,000, was derived from siliceous ores; 28 per cent, or $120,000,000, from copper ores; 27 per cent, or $116,000,000, from lead ores; and 9 per cent, or $39,000,000, from other complex base metal ores. Over 80 per cent, or $31,000,000, of the silver produced from other than siliceous, copper and lead ores was derived from lead-zinc ores. Only 0.2 of 1 per cent, or $900,000, of the total silver production, was recovered from placer operations. While the average for the decade shows that 64 per cent of all the silver was produced as a byproduct, only 9 per cent of the total gold was produced as a byproduct of base metal ores.

The total value of the gold and silver production in the United States from 1909-1918 was $1,330,000,000, of which 73 per cent, or $971,000,000, was derived from siliceous ores and gravels; 14 per cent, or $186,000,000, from copper ores; and 13 per cent, or $173,000,000, from ores containing lead, copper and zinc in combination, chiefly lead and lead-zinc ores.

It is a unique coincidence that the analysis of mine production data shows that 73 per cent of the total value of the combined gold and silver production was derived from siliceous ores and gravels, while the analysis of the index demonstrates that 73 per cent of the total number of corporations, partnerships and individuals engaged in the production of the precious metals produce principally gold and silver. As far as the production of gold and silver is concerned, the analysis of the mailing list gives precisely the same result and is, therefore, an excellent index to the origin of the precious metals.

Only 14 Per Cent Produced From Copper Ores

The mine production data shows that 14 per cent of the total gold and silver is derived from copper ores, while the index shows that 18 per cent of the total corporations, partnerships and individuals are producing gold and silver in combination with copper. A further comparison shows that 13 per cent of the total value of gold and silver is derived from ores containing copper, lead and zinc combinations (chiefly lead and lead-zinc ores), while but 9 per cent of the total number on the mailing list is engaged in similar production. These last two comparisons may be partially accounted for on the ground that there is more concentration of capital in the development of very complex ores, while there is a greater subdivision of capital in the production of copper ores containing gold and silver. This would indicate that the more complex the metallurgical problem, the heavier is the necessary capital investment to conduct the industry on a successful commercial basis. Generally the analysis based upon actual mine production agrees so closely with that of the incorporated companies, partnerships and individuals producing gold and silver that the conclusion may be drawn that the segregation made in the mailing list is sufficiently accurate to serve as a basis for the Institute's correspondence in avoiding unnecessary duplication and expense.

INCORPORATED COMPANIES, PARTNERSHIPS AND INDIVIDUALS PRODUCING GOLD AND SILVER IN THE UNITED STATES

Producing principally	Incorporated Companies		Partnerships		Indivuals		Total	
Gold	837	68%	108	90%	312	85%	1,257	73%
Silver	385		91		119		595	
Gold and silver	456		67		74		597	
Copper and gold	28	32%	...	10%	...	15%	28	18%
Copper and silver	67		9		33		109	
Copper, gold and silver	394		20		51		465	
Lead and silver	68		...		1		69	9%
Lead, silver and gold	82		...		...		82	
Copper, lead and silver	28		...		...		28	
Copper, lead, silver and gold	119		...		...		119	
Total	2,464		295		590		3,349	

American Electrochemical Society Meets in Montreal

Good Attendance and Long List of Technical Papers Feature Forty-second Annual Convention

THE forty-second annual meeting of the American Electrochemical Society was held at the Windsor Hotel, Montreal, Sept. 21 and 22, with an attendance of about 200, including members of sister societies. The chair was occupied by President C. G. Schluderberg, of the Westinghouse Co., of Pittsburgh. A welcome was extended by Alderman Seybold on behalf of the city and by Dr. R. F. Ruttan, of McGill University, on behalf of the scientists of Montreal. A long list of technical papers was presented, which were grouped according to the topics treated. The first group, dealing with electrolysis, included papers by Ralph B. Abrams, on "The De-zincification of Brass"; Walter G. Traub, on electroplated zinc and the diffusion of electro-deposits into zinc; John T. Ellsworth, on the effect of single impurities on the deposition of zinc from sulphate solutions; M. B. Thompson and C. T. Thomas, on the effect of impurities in nickel salts used for electro-deposition; and Ernest E. Vuilleumier, on the application of the contractometer to the study of nickel deposition.

The second group included a number of papers on industrial heating, treating of the various problems created by the use of electricity for heating purposes. "The Underlying Principles of the Industrial Heating Problem" were set forth in a paper by Charles P. Steinmetz. E. F. Collins dealt with the generation of electric heat and its application to industrial processes. E. L. Smalley's subject was the "Principles of High-Temperature Furnace Design." M. A. Hunter and A. Jones discussed "Some Electrical Properties of Alloys at High Temperatures." J. C. Woodson treated of "Heat Insulating Materials for Electric Heating Apparatus." Frank W. Brooke gave a comprehensive address describing the methods of economically handling materials in electric furnaces, illustrated by diagrams showing the different types of furnaces necessitating different modes of operation. The advantages of electric heating were set forth by Wirt S. Scott, who also contributed an interesting paper on the "Development of Electric Heating for Low-Temperature Enameling." E. L. Smalley, in a paper on "Firing Ceramics in Electric Furnaces," contended that the installation of small furnaces in connection with the ceramic industry would encourage artistic development. This created some discussion, most of the speakers regarding it as commercially impracticable.

C. B. Gibson, in a paper on "Electric Annealing of Malleable Iron," stated that while development had not yet been secured on a commercial scale, it had been shown that electricity secured a more even distribution of heat than fuel, and its higher cost was more than counterbalanced by its advantages. The American Malleable Association was conducting extensive tests in electrical annealing. P. S. Gregory dealt with "Electric Steam Generators and Their Application," showing the improvements in design which had been effected. They could be used anywhere, whether power was available or not, but their application must be considered in reference to the conditions prevailing.

"A New Type of Induction Furnace" was described by J. Murray Weed. The heat was produced by an electric current induced by transformer action in a looped portion of the molten charge. Its success depended upon a continuous automatic circulation or the molten metal between the secondary and the melting pot.

Papers were read by H. C. P. Weber on "Changes in the Electrical Conductivity of Varnishes During Drying," and by C. J. Rodman, on "Arc Action on Some Liquid Insulating Compounds."

A smoker was held on the evening of the 22d, and on the following day a number of the members visited Shawinigan Falls and inspected the plants of the Shawinigan Water & Power Co. and other industrial works.

American Mining Congress to Consolidate Southern Chapters and Push Muscle Shoals Project

The American Mining Congress will hold a convention at Chattanooga, Tenn., on Sept. 29 for the purpose of organizing a Southern Division of the organization, to consolidate its existing state chapters in the South. Active support will be given to the Muscle Shoals power project. J. F. Callbreath, secretary of the Congress, states that "many mining operators in the South have never awakened to the possibility of utilizing the efficiency of large operations analogous to the development of the porphyry coppers of the West. The widely diversified and disseminated deposits of graphite, phosphate, manganese, barytes, and other minerals in the Southern states, and their successful marketing, call for collective thought and co-operative action," which it is the purpose of the Mining Congress to foster.

Eastern Engineers Visit the Coeur d'Alenes

A party of engineers, most of them from New York, on their way to San Francisco to attend the semi-annual meeting of the American Institute of Mining and Metallurgical Engineers, spent two days in the Coeur d'Alene district on Sept. 18 and 19 and were entertained by local engineers and executives of the various mining companies. They arrived at Kellogg at noon in a private car, and in the afternoon they visited the Bunker Hill & Sullivan mine and smelter. In the evening they were guests at a dinner, at which Stanly A. Easton, manager of the Bunker Hill & Sullivan, presided. Addresses were made by A. S. Dwight, president of the Institute; F. F. Sharpless, secretary, and Rush J. White, of Wallace, chairman of the Columbia Section. The night was spent at Wallace and the following forenoon the engineers visited the Hecla mine, at Burke, and the Morning, at Mullan. Many of the engineers were accompanied by their wives, who were entertained at Kellogg by Mrs. Stanly A. Easton and at Wallace by Mrs. C. W. Newton, wife of the manager of the Callahan Zinc-Lead Co. The party was made up of A. S. Dwight and wife, F. F. Sharpless and wife, George D. Barron and wife, H. J. Stehli and wife, R. L. Baldwin and wife, Miss M. Baldwin, N. T. Spencer, Miss M. J. Spencer, E. F. Eurich and Carroll Hutchins, all of New York; Robert Ammon, of Knoxville, Tenn., and Sherwin F. Kelly, of Lawrence, Kan.

SOCIETY MEETINGS ANNOUNCED

The American Welding Society will hold a meeting at Chicago on Oct. 2-5.

The fall meeting of the **American Society of Civil Engineers** will be held at San Francisco Oct. 4-8. The meeting will be devoted largely to a forum on "The Water-Power Problem."

The first monthly meeting of the **New York Section of the American Institute Mining & Metallurgical Engineers** for the 1922-1923 year will be held at the Machinery Club, 50 Church St., New York City, on Oct. 4, 1922. Informal dinner will be at 6 o'clock, and the program at 8. The speakers are to be Frank A. Vanderlip, of New York, and Edgar Rickard, director general of the American Relief Administration.

More than one thousand engineers are expected to attend the fourth anual meeting of the **Army Ordnance Association**, which will be held at the Aberdeen proving ground on Oct. 6. A program of test firings and demonstration of the more recent developments in ordnance material and ammunition has been arranged. Though the invitation is limited to members of the Army Ordnance Association, the American Society of Mechanical Engineers, and the Society of Automotive Engineers, it is pointed out that there will be so many features of the program of interest to chemists and electrical and civil engineers that a large representation from these branches of engineering probably will be present. The requirements for an invitation can be met by any American citizen, who is not a member of any one of the three societies mentioned, by taking out membership in the Army Ordnance Association. Chemists and others will be interested particularly in the tests of the recently devised non-hydroscopic, flashless, smokeless powder.

PERSONALS

A. L. Clark has gone to Miami, Ariz., to study conditions there.

F. M. Manson, of Reno, Nev., was recently in San Francisco.

Fred W. Bradley has returned to San Francisco from Kellogg, Idaho.

James M. Hill is engaged in field work in Plumas County, Calif.

F. H. Moffit has returned to Washington after field work in Alaska.

F. Siebert has left Reno on a professional trip to San Francisco and Randsburg, Calif.

R. C. Moore has returned to the University of Kansas after a season's field work in Plumas County, Calif.

Thayer Lindsley has been made president of the Homestead Iron Dyke Mines Co., at Homestead, Ore.

L. W. Stephenson and **C. W. Cooke** are doing geological field work in the Carolinas and Georgia.

A. B. Rogers, who is operating the King of Arizona mine, near Yuma, was in San Francisco last week.

C. M. Weld, of Weld & Liddell, New York, will be in West Virginia on professional work for two weeks.

Thomas A. Graves has been made manager of the Canadian Associated Goldfields, Ltd., of Goldfields, Ont.

C. E. Waldner, mining engineer for the West End Consolidated Mining Co., at Tonopah, Nev., is in San Francisco.

D. M. Liddell, chemical and metallurgical engineer, has returned to New York after a short business trip to Chicago.

E. W. Juessen, of San Francisco, is in Virginia City, Nev., making an examination of the Consolidated Virginia and Ophir mines.

Price McKinney, of Cleveland, has just made an inspection trip over the McKinney Steel Co.'s properties in the Lake Superior district.

Philip Andrews, formerly on the engineering staff of the Eagle Picher Lead Co., is now connected with the Colorado Geological Survey.

Waldemar Lindgren, who has been making several geological examinations in Nevada, passed through San Francisco on his way to Los Angeles.

Miss Julia A. Gardner has returned to Washington from field work in Texas in co-operation with the Texas Bureau of Economic Geology and Technology.

D. G. Kerr, of Pittsburgh, Pa., vice-president of the U. S. Steel Corporation, is spending the month of September in the Michigan woods with a party of associates.

L. B. Weed, general superintendent of the Colorado Fuel & Iron Co., accompanied by a party of friends, visited the various points of interest on the Mesabi iron range last week.

F. B. Tough, United States supervisor of oil and gas operations on leased public lands, has been appointed chief petroleum technologist of the Bureau of Mines, to succeed **A. W. Ambrose**, made assistant director of the Bureau. Mr. Tough's appointment is effective Oct. 1. Mr. Tough holds the degree of Engineer of Mines from the School of Mines, Columbia University, New York. Before entering the service of the Bureau of Mines, he had several years' experience as resident geologist for the Southern Pacific Company in various oil fields in California. After coming with the Bureau of Mines, Mr. Tough specialized in problems dealing with the exclusion from oil and gas wells of encroaching underground waters. In

F. B. Tough

1919 and 1920 Mr. Tough was in charge of conservation work in the Wyoming oil fields, under the co-operative agreement with the Rocky Mountain Petroleum Association. In the spring of 1920, Mr. Tough was appointed United States Supervisor of Oil and Gas Operations under the provisions of the General Leasing Act, continuing, however, to act as engineer in charge of the Rocky Mountain Petroleum Association work until its completion, the two pieces of work overlapping by about six months.

N. H. Emmons, 2d, of Boston, is spending several weeks on the Michigan ranges making a geological examination of the mines which the Keeweenaw Association owns in fee.

M. M. Duncan, vice-president and general manager of the Cleveland-Cliffs Iron Co., was a recent visitor on the Mesabi iron range. He made a tour of inspection of the company's properties.

A. A. Cole, mining engineer for the T. & N. O. Ry., has returned to Cobalt from an airplane visit to James Bay. A return trip was formerly a matter of weeks, but can now be made in a few hours.

Frank L. Culver, president of the Beaver Consolidated, has returned to Toronto after visiting the Beaver Mine at Cobalt, as well as the Kirkland Lake Gold Mining Co.

Austin Y. Hoy, manager of the London office of the Sullivan Machinery Co., Chicago, has just arrived in this country to spend a month's vacation with friends and relatives in the Middle West.

W. F. Ulrich, formerly chief chemist for the Oliver Iron Mining Co., in the Chisholm district of the Mesabi iron range, has been made superintendent of the Trout Lake concentrator at Coleraine, Minn.

Willet G. Miller, Fred. E. Wright, Charles Palache, and **R. A. Daly** are returning from South Africa, where they visited the mines at Johannesburg and Kimberley as missionaries of Canadian and American goodwill.

David G. Kerr, vice-president of the U. S. Steel Corporation, and **Taylor Allerdice**, vice-president of the National Tube Co., made a recent visit to the iron ranges in Minnesota on a combined business and pleasure trip.

A. B. Patterson, general superintendent of the production department of the Texas Co.'s south Texas division, has resigned to take charge of the field operations of the Producers and Refiners' Corporation, with headquarters in Denver.

Dr. J. W. Beede has resigned as geologist for the Bureau of Economic Geology and Technology of the University of Texas, at Austin, to accept a position on the geological staff of the Empire Gas & Fuel Co. Dr. Beede came to the University of Texas from the University of Indiana.

George A. Bole has been appointed superintendent of the ceramic experiment station of the U. S. Bureau of Mines at Columbus, Ohio. For the past five months he has been acting superintendent of that station. Mr. Bole joined the Bureau of Mines staff Aug. 6, 1921, as an associate chemist. For nine years prior to that time he had been professor of ceramic chemistry at Alfred University. He was graduated from Geneva College in 1906 and from Columbia University in 1911.

Ira B. Joralemon has left Bisbee for San Francisco, where he will open offices as a consulting engineer and geologist. On his retirement from the position of assistant general manager of the Calumet & Arizona Mining Co., he was the guest of honor at a dinner given at the Warren District Country Club by J. C. Greenway, general manager, and other executives of the C. & A. staff. About eighty-five mining associates were present. Mr. Joralemon was presented with a handsome watch.

Mining and metallurgical engineers visiting New York City last week included: **R. A. Schmucker**, of Red Hook, N. Y.; **D. M. Collingwood**, of Urbana, Ill.; **H. H. Utley**, of Florence, Colo.; **Rudolf Gahl**, of Denver, Colo.; and **B. M. O'Harra**, of Rolla, Mo.

THE MINING NEWS

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Leading Events

WAGE INCREASES in Western districts become general. Coeur d'Alene and Butte companies fall into line.

Commission will investigate Argonaut mine disaster.

Supreme Court of Arizona sustains lower court's decision for the defendant in the Tom Reed-United Eastern apex controversy at Oatman.

The Nevada Consolidated company resumed milling of ore at McGill on Sept. 15, only two months and six days after the disastrous fire that destroyed the concentrator. A wage increase went into effect the same day.

Iron mining companies on the Mesaba range in Minnesota have increased wages.

The National Lead Co. invests $1,500,000 in Llallagua Mines, largest tin producer in Bolivia.

The Black Eagle Co. of Picher, Okla., has purchased the leases and mill of the United States Smelting & Refining Co. in the Miami district.

The Chestatee Corporation is given substantial additional award under new War Minerals Relief Act.

Calumet & Hecla increases current production by mining richer "rock."

The net production of the California Rand mine is reported as $1,327,623 for the year ended Sept. 1.

Two Ontario mines, the Castle and Paymaster, are considering mill construction.

Coeur d'Alene Mining Companies Advance Wages

New Scale $5 for Miners; $4.50 for Muckers—High Price of Lead Reason Assigned by Managers

Effective Oct. 1, all employees of the mines of the Coeur d'Alene district, in Idaho, will receive an advance in wages amounting to 75c. per day for miners and timbermen and 50c. per day for muckers and surface laborers. This announcement was made following a meeting of managers of all the large operators, and was the direct result of the steady advance in the price of lead, which on the day of the meeting was quoted at 6c. per pound and has since advanced to 6.10c. Under the new schedule miners will receive $5 per day, timbermen $5.50, muckers $4.50, and surface laborers $4.25. Under the present system there has been a difference of only 25c. per day between the pay of muckers and miners, but the new scedule will make the difference 50c. per day. It is expected that this advance in wages will result in relieving the shortage of miners, which for many months has been a serious handicap to mining operations. The advance was made voluntarily by the companies.

Butte Raises Wages

Effective Sept. 21, miners, smelter men and craftsmen of the mining companies operating in Butte received a wage increase of 50c. a day. The men total approximately 12,000, this number including the employees of the Anaconda Copper Mining Co. at Anaconda and Great Falls. The new wages will give miners $4.75 a day, this being the scale for both miners and muckers.

Nevada Consolidated Has Started Two Units Following Mill Fire

Two units of the Nevada Consolidated concentrator, burned on July 9, were started on Sept. 16, and two more will follow about Oct. 1. An ore train from Ruth to McGill is now running regularly. One unit of the steel building is up and riveted, and steel for the ore bins is on the way. The total fire loss has been estimated at $1,500,000.

Special Board Will Investigate Argonaut Mine Disaster

W. D. Stephens, Governor of California, Appoints Prominent Men on Commission—One Body Remains Unfound—Inquest Begun at Jackson

By wire from our San Francisco Correspondent

San Francisco, Sept. 25.—Forty-six bodies have been recovered from the Argonaut mine, but the body of William Fessel, whose name appeared in the message left burned on the walls of the crosscut and who, it is now concluded, must have been in another part of the mine, has not been found, although a thorough search has been made during the week. Impressive funeral services were held in Jackson on Sept. 22. The Coroner's inquest began on Sept. 25, and promises to be thorough. Governor W. D. Stephens has appointed A. B. C. Dohrmann, a prominent business man of San Francisco and president of the Industrial Welfare Commission; W. J. Loring, mine operator and president of the American Mining Congress, and John C. Williams, president of the Miners' Union of Grass Valley, as members of a board to investigate all phases of the catastrophe.

Supreme Court Sustains Decision in Tom Reed-United Eastern Suit

Segments of Faulted Vein Must Be Considered as Having Individual Apexes

The Supreme Court of Arizona has sustained the decision in favor of the defendant in the Superior Court of Mohave County in the suit of the Tom Reed Gold Mines Co. against the United Eastern Mining Co. The suit was based upon a claim of the plaintiff upon the ore (considered worth $2,500,000) contained in a very rich vein within the lines of the defendant corporation's ground. Apex rights were claimed to the vein, despite a nearly vertical fault of several hundred feet upward. That the segments of the vein had been one was not denied by the defendant, but it set forth the contention that present-day conditions alone must govern the law of the apex and that the faulted portion should be considered an entirely new orebody.

The suit dates back to 1915, when in the Big Jim claim, now owned by the United Eastern, at 200 ft., a new body of ore was struck; this was later demonstrated to be a segment that had faulted on the incline of the vein in the Grey Eagle claim of the Tom Reed. Tom Reed sunk a shaft on the Grey Eagle to the depth of 600 ft., there encountering what now is known as the Mallery fault, where its orebody ended. The plaintiffs contended that they had a right to rise, on an angle 430 ft., and continue the taking out of ore on what they considered a continuation of their vein.

The United Eastern claimed that the apex law was enacted for the bene-

fit of miners, and that conditions in mining must be met as they exist today, not as they may have existed. In order to follow the vein, they said, it would be necessary to go upward to meet the Big Jim ore, all of which is not contemplated by the apex law, which provides that the vein may be followed on its "downward course." The Superior Court declared the existence of three distinct orebodies, the Tom Reed, Sideline, and Big Jim veins, permanently separated for centuries, and that the Big Jim vein must be considered as wholly within the ground of the defendant, this including its underground apex. The Mallery fault was declared not mineralized and not to be considered a vein.

The Supreme Court approved the proposition set forth by the lower court that, "if veins are separated permanently and cannot be followed as the same vein, and if it is necessary to pass through great distances of country rock in order to connect them, in which distances there are neither mineralized walls nor seams, such veins must be deemed separate and distinct ones and cannot be identified as one and the same."

The judgment was written by Justice Edward J. Flanigan, and was concurred in by Justices Ross and McAlister. The attorneys in the case were John P. Gray, of Coeur d'Alene; R. L. Alderman, of Los Angeles, and C. W. Herndon, of Kingman, for the winning side, and William B. Colby, of San Francisco, and Louis L. Wallace, of Kingman, for appellant.

Chile Copper Makes Record Production in August

The Chile Copper Co. established a new production record at its mines in South America during August by turning out 13,141,000 lb. of metal. This copper was mined, treated and delivered to consumers at an average cost of 6.35c. per pound. In the preceding month Chile fell just short of 13,000,000 lb. and produced it at a cost of 6.15c. per pound. These cost figures do not include depreciation, depletion, or a reserve for federal taxes.

To some extent Chile Copper's cost is dependent upon the rate of exchange. The normal pre-war level of Chilean exchange has been about 5 pesos to the American dollar. During the last half dozen years the peso sold down to 10 and 11 to the dollar. It has recovered until it is at present about 7 to the dollar, an exchange ratio on which Chile's present costs are calculated. Should the peso get back to its normal parity of 5 to the dollar the cost would necessarily increase.

Current production is running at the rate of 156,000,000 lb. of copper a year. In July the company treated about 407,000 tons of ore and in the following month put 435,000 tons through its reduction works. This is at an annual rate of 5,000,000 tons and is over three times the amount of ore mined and treated in 1921.

Mexican Miners at Cananea Resent Physical Examination

Mexicans applying for employment by the Cananea Consolidated Copper Co., in Northern Sonora, are deeply resentful of the order of the company requiring physical examination for all prospective employees. The contention is that this places the men on the same level as criminals, and considerable agitation against the company has resulted. Officials have difficulty in explaining the purpose of the order.

Canadian Mineral Production Increases—Gold Output Is the Feature

According to a survey made by the Canadian Bureau of Statistics, the total estimated value of the mineral production during the first six months of 1922 was $57,682,944, in which $26,475,544 represented the value of the metal production and $31,207,400 the non-metals. As compared with the same period in 1921 the value of the metals is seen to have increased about $2,000,000, or 9.1 per cent.

The ten principal products of the mineral industry in Canada during the half-year period in order of the values assigned were: Coal, $24,346,959; gold, $12,110,242; silver, $5,997,199; lead, $2,882,047; natural gas, $2,448,829; copper, $2,337,093; asbestos, $1,894,232; nickel, $1,401,820; zinc, $1,370,460; and salt, $849,133.

The outstanding feature of the metal production was the excellent gains made in the output of gold by the two important producing provinces, Ontario and British Columbia. The total for Canada during the period amounted to about 63 per cent of the whole 1921 production, and an increase of 42 per cent over the production during the first six months of that year. The increased prices and the good markets for silver and lead were reflected in excellent gains in production over the half-year of 1921. The zinc production remained about the same, cobalt increased slightly, and copper and nickel, as might have been expected, fell off considerably.

National Lead Co. Invests $1,500,000 in Bolivian Tin Mines

The National Lead Co. has acquired an interest in the Compania Minera de Llallagua, of Bolivia, the largest single tin producer in the world. Purchase of shares was aided by the decline in the Chilean peso to less than 10c. at the same time that shares were quoted at less than normal on the Valparaiso exchange. National Lead's holdings, together with those of Simon Patino, the largest individual tin-mine owner in Bolivia and known as tin king of South America, represent control, according to reports.

Llallagua Mines is a Chilean corporation with 475,000 shares of stock of £1 par. Llallagua has comparatively as large a speculative following in South America as United States Steel here. It has paid so far this year two interim dividends of 5s. each. The National Lead Co. has invested about $1,500,000 in the shares.

The world's tin production amounts to only about 100,000 to 120,000 tons annually, of which about 40,000 comes from Bolivia and most of the rest from Straits Settlements. Llallagua Mines and Simon Patino together represent about 90 per cent of Bolivian production. The National Lead Co. uses about 10,000 tons of tin annually and is the largest single consumer of tin in the world, except the United States Steel Corporation, which takes about 14,000 tons a year for plating.

Douglas Asks Los Angeles to Help Obtain Low Rail Rate on Copper

James S. Douglas, president of the United Verde Extension Co., has been refused a rate of $4 a ton on copper from Clarkdale, Ariz., to Los Angeles Harbor, on shipments intended for foreign export, or of $5 a ton on copper for domestic consumption. He has appealed to the Interstate Commerce Commission and has asked the Los Angeles Chamber of Commerce for help. It is understood that the Santa Fe Railroad Co. would assent to the rate if it were given harbor terminal facilities at San Pedro.

Michigan Copper Mines Get Automobile Workers — Numerous Advantages Compensate for Lower Wages

Although the Calumet & Hecla company is supplied with men, the mines in the south end of the Lake Copper Country, principally Copper Range and Quincy, are in need of miners and trammers. To help supply this want, the Houghton Association of Commerce recently notified the Detroit Board of Commerce that work was available in the copper mines for men of underground experience, and as a result a considerable number of men who have been employed in the Ford plant are going to the mines. Many of them formerly worked either in the copper or iron districts.

With the 15 per cent wage increase announced by Copper Range and Quincy, the rate for trammers is $3.20 per day and miners are paid $3.65. This wage is smaller in comparison with what Ford workers have been receiving, but other compensations make up the difference. Comfortable, modern houses rent for only $1 per room per month, making the average rental only $5 or $6, whereas rents in Detroit are high and take a large share of the worker's earnings. No charge for water is made by the mines, and, in addition, fuel is provided at cost. The fuel problem is a serious one in Detroit just now, and the saving in this one item alone is considered important.

Adargas-Jiminez Railroad, in Mexico, Is Completed

Transportation by Rail and Motor Truck Being Improved in Mining Districts of the Republic

Another important private mine railroad in Mexico will soon be placed in regular operation. It runs from the Adargas mines, in the State of Chihuahua, to a connection with the National Railways of Mexico at Jiminez, eighteen miles. The mines and railroad are owned by Paul Ginther and associates. The track of the new line has been laid, and as soon as the rolling stock is received hauling of ore will start. Quantities of silver and lead ore upon the dump await shipment to the smelter. The machinery and equipment of the mines are operated by electric power, which is obtained from the hydro-electric plant of the Mexico Northern Power Co. at Boquillas.

With the revival of mining in Mexico the necessity of improving transportation facilities is being made increasingly apparent. It is said that several other large companies plan to build their own railroads and to purchase cars and engines for handling their traffic. Many motor trucks are being used for hauling ore, and the demand for this type of transportation equipment is constantly increasing. With the increasing use of motor trucks for this purpose, the improvement of mountain roads leading to mining camps is receiving attention.

Australian Arbitration Court Authorizes Reduction in Basic Wage of Miners

By Cable from Reuters to "Engineering and Mining Journal-Press"

Melbourne, Sept. 20.—The Arbitration Court has granted the Wallaroo and Moonta Mining Co. permission to employ men at a rate of 10s. a day, which lessens the basic wage, in order to allow resumption of operations on a profitable basis. The decision affects 1,250 employees, who approved the reduction, while union officials strongly opposed it.

Echo of Labor Shortage Comes From British Columbia

The large mining companies in British Columbia report a shortage of good miners and skilled help generally. The Tidewater Copper Co., operating at Sidney Inlet, Vancouver Isand, is anxious to re-start its mill, which has been closed for some time on account of water shortage, but has been unable to get miners to provide the mill feed. The Consolidated Mining & Smelting Co. is not making the progress it desires to with its new concentrator at Kimberley, on account of a shortage of carpenters and skilled mechanics. The large concerns in the northwestern part of the province make similar complaints. Skilled labor is being paid from $3.75 in the interior to $4.25 at the coast, with board averaging $1 per day.

Map in Dead Doctor's Effects Leads to Gold Discovery

Hope, British Columbia, is the scene of great excitement as a result of the reported discovery of immensely rich gold ore about eight miles from that village. William Bradley and John Viking, who made the discovery, but who refuse to give the exact location, brought in a sample of ore that assayed $1,340 in gold and silver. The prospectors say that the vein is 13 to 14 ft. wide, and has been traced for a long distance. They have gone back to the claim with a view to staking more ground. Romance enters the story. A Chinese prospector told a Dr. Cox of the discovery and gave him a map showing where it was, in consideration of medical treatment. The Chinaman returned to China, and Dr. Cox thought no more about it. Some time ago the doctor died, and the map fell into the hands of Bradley and Viking, who maintain that the map led them straight to the outcrop.

Mesaba Iron Mines Increase Wages —Resumption of Underground Work Expected

In several instances public announcement has been made of a 15 per cent increase in wages by independent mining companies on the Mesaba iron range, in Minnesota, to be effective Sept. 1. All mining companies have not signified their intention of increasing the wages and salaries of their employees, but it is generally assumed that they will increase them. The tardiness of such announcements is attributed to the preparation of schedules and final word from general offices. Many underground properties have not reopened on the iron ranges in Minnesota since the general depression; ore demands were met in nearly all cases by shipments from stockpiles and open pits without the aid of the underground properties. There is reason to believe under the present favorable conditions that many of the underground mines will again be opened.

News from Washington

By PAUL WOOTON
Special Correspondent

Chestatee Corporation Awarded Additional $469,784 for Loss in Pyrite Operations

War Minerals Commissioner Gives Reasons for More Liberal Settlement of Claim — Allowances for "Financing" and for Railroad Construction Approved

AN ADDITIONAL AWARD of $469,784.62 has been recommended by the War Minerals Relief Commissioner in the claim of the Chestatee Pyrites & Chemical Corporation of Atlanta, Ga. This company already has received $223,529.17 under an award from the previous commission. If this latest award is approved by the Secretary of the Interior, the Chestatee company therefore will have received $693,313.79 to reimburse it for the losses incurred in an effort to produce pyrite to meet the war need.

The opinion recommending the additional award in this case, which is regarded as the most important single claim brought under the amended War Minerals Relief Act, covers twenty-three typewritten pages. In summing up the evidence, John Briar, the assistant commissioner, says:

"In reviewing this claim, I have been struck by the magnitude of expenditures and the possibilities of output. The very bigness of it tends to lead an examiner unconsciously to fail to give the claimant full justice, but that I have tried to overcome. If I have seemed to deal with it liberally, it is because the record shows that the then Secretary of the Interior, realizing, no doubt, that this property presented opportunity for the largest production of pyrites in the entire country, used every means in his power to persuade the claimant to develop it."

The action of the former commission on this claim comes in for attention in the opinion. Among other things, the opinion states:

"This was the first claim considered under the original War Minerals Relief Act. The commissioners had had no experience in dealing with big complex claims. No rules or policies had been tested by actual application. They attempted to fix the loss through percentages, that is, by basing it upon the proportion which the amount the claimant meant to expend and produce under his own non-stimulated plans bore to the estimated expenditure and production of the bigger mill, under government stimulation. The result was that the percentage fixed by the commission was increased by the secretary and later still further increased, with the claimant insisting that all were too low, and that the per cent should apply to all the expenditures instead of to only a part of them.

"In the present review, the former plan is not ignored entirely, but the claim is considered practically *de novo*, in the belief that it is better to apply rules that have grown out of experience than to consider merely the alleged errors of a plan which is unfamiliar, because it was abandoned long before the amended act, under which we now are considering these plans, was passed. The auditor was directed to audit this claim in the same manner that all

claims now are being audited. This means that he was to treat the company as a going concern on the date of stimulation; that any loss or profit prior to that date was the claimant's own, with which the government is not concerned; that all expenditures during the stimulation period, or which properly should be charged to the period, were to be listed; that deductions for items not allowable and for salaries were to appear and that the net loss was thus to be shown."

Other features of the claim are dealt with in a manner indicated by the following extracts from the opinion:

"The expenditures for the building of the railroad, which heretofore have been denied, are allowed. Considered under the amended act, and in the light of the accepted practice, there is no reason whatsoever why the expenditures for this railroad should not be compensated. The claimant, before stimulation, may have had in mind some day to build the road. He may have taken advantage of the opportunity to purchase some rails, at a low price, but there is not the certainty that he ever would have built it. A fair deduction would be that the plan to build the road had been abandoned. There is the certainty that the road was built after government stimulation; that Secretary Lane approved if he did not direct the building; that it was necessary in connection with the mining project and the claimant testifies that but for such stimulation and such urgency the expenditure would not have been made. The record is so clear and so complete as to details that there can be no reasonable doubt as to government responsibility.

"All interest charges have been deducted. It is not believed that the act contemplates the payment of interest on borrowed capital.

"I am of the opinion that 10 per cent is a reasonable allowance for the financing in this particular claim. The amount of money required to meet the government demands was so great as to make the securing of it by ordinary means almost impossible. The activities of the government to induce Ashcraft and Wilkinson to finance the claim, so that war needs might be met quickly and in large measure, were personal, direct, and effective. The fact that Secretary Lane, who himself had a part, not only in the stimulation of the claimant, but, through suggestion, in the financing, recognized that Ashcraft and Wilkinson had performed a service to the government, is evidence of that service. The contract which they had with the claimant furnishes no basis for fixing the amount to be allowed, but a fair adjustment can be reached by a study of all the events connected with the transaction. The 10 per cent for financing should apply only to the amount of the loan which went into stimulated operations—namely, $645,000—so that the allowance which is here recommended is $64,500.

"In this review, it is held that the claimant is fairly entitled to a rental or depreciation allowance of 20 per cent on the machinery and equipment purchased before stimulation but used during stimulation, and the entire purchase price of the supplies which were so used or consumed and deprived of all salvage value. In this claim, the equipment and machinery rented was a part of the plant as finally sold and salvaged. That fact was considered when the amount of salvage of the entire property was fixed, and therefore the 20 per cent now mentioned for rental is not subjected to increase on account of salvage.

"A subsistence allowance of $4,032 for G. L. and N. P. Pratt was substituted for the salary charge of $25,966.67 which appears in the claim. A straight salary allowance to a partner or part owner of a property would mean granting of a profit to him. Subsistence is allowable, but if he is to receive compensation above subsistence, it must come from profits earned."

Pottery Kiln Most Efficient for Brick Making

With the conclusion of comprehensive tests and observations at brick kilns at Bradford, Pa., and at Peoria, Ill., the crew of the Bureau of Mines car, "Holmes," has concluded an extended series of tests throughout the country in co-operation with the manufacturers of heavy clay products. The tests at Bradford were at a kiln of the Dressler type. That test was of particular interest, since that type of furnace has been used almost exclusively in the making of expensive clay wares. It is contended, however, that this better type of kiln can be used to advantage in ordinary brick production, since it makes possible economies not practicable in the cheaper kilns.

Bill Would Abolish Strikes—Compulsory Registration and Arbitration Sought

A bill for the compulsory incorporation of labor unions and compulsory arbitration of industrial disputes has been introduced in the House by Representative Fairchild, of New York, and referred to the Committee on Labor, which will consider it at the December session of Congress. The measure would provide that all labor unions be enrolled as "national unions" under the Department of Labor, for which purpose the bill would create the office of Commissioner of Enrollments, with an annual salary of $7,500 a year. Employers of more than twenty-five workers also would be obliged to enroll.

A penalty in the form of a tax of $5 a year would be levied upon all members of unions not enrolled in the national union. The national unions, to be organized according to occupations, would be obliged to write into their bylaws a provision against disturbing the regular commercial life of the country and agree to submit all controversies which cannot be composed by private negotiation to the courts of the United States and to accept their decision on final appeal without further controversy. A violation of the latter clause would be considered a misdemeanor punishable by a fine of $5 a day, and no employer would be able to hire a worker not a member of a national union on penalty of a fine of $5 a day for each outside worker employed.

Bureau of Mines Pleased With Experiments in Leaching Copper With SO_2

The Bureau of Mines is much encouraged by the results being obtained by the application of the sulphur-dioxide leaching process. A report from the Tucson station states that leaching recoveries above 96 per cent have been obtained in the test work on ore taken from the Big Indian mine, thirty miles south of Moab, Utah. The use of iron as a precipitant, says the report to the Bureau, insures a higher recovery than appears possible by electrolysis.

The Big Indian mine is a low-grade copper property seventy-two miles from the nearest railroad point. Owing to the location of the property and to the character of its ore, it was selected for use in these experiments. A co-operative arrangement with the owners was effected. Edmund S. Leaver, the metallurgist in charge, predicts that the successful commercial operation of the property will be possible. The values in the ore are all copper, occurring as azurite and malachite in sandstone.

Potash on Free List

Among the items that are duty free in the new tariff bill are potassium salts, which were the subject of bitter debate before the measure was passed. In schedule 15, as the free list is entitled, appear the following:

"Par. 1645. Potassium chloride or muriate of potash, potassium sulphate, kainite, wood ashes and beet-root ashes, and all crude potash salts not specially provided for.

"Par. 1646. Potassium nitrate or saltpeter, crude."

Transfer of River Steamers Will Facilitate Transportation in Alaska

The War Department has transferred to the Department of the Interior, for the use of the Alaska Engineering Commission, the river steamers formerly operated in the Army service on the Tanana River. Hereafter, the Engineering Commission is to operate these boats in connection with the railroad to carry government passengers and freight. It is anticipated that Congress will grant authority so that they may carry commercial freight and passengers also. In this way it will be possible to extend to the mining districts along the river the benefits of through rates and bring to them the lower costs now enjoyed by the properties immediately tributary to the railroad.

News by Mining Districts

London Letter

"Business Deal—No Politics" Says Urquhart of Russian Agreement—Details of Arrangement

BY W. A. DOMAN

London, Sept. 15.—With the persistence which has characterized him in regard to the immense Russian properties for which he is responsible, Leslie Urquhart has once again approached the Soviet representatives for permission to resume operations. For some time he negotiated with M. Krassin in Berlin, and last Monday he reported that his efforts had met with success. He says: "I think everyone will regard it as a good business deal. There are no politics in it at all. We are to have our property returned on very fair terms, and I am satisfied that the deal is a movement toward the renewal of trade relations with Russia."

Coming so closely on the heels of his denunciation of the Russian Governments' methods, this pronouncement shows clearly that the Soviet chiefs have changed their attitude and made considerable concessions. In brief the arrangement concluded is as follows: All of the Russian properties of the Russo-Asiatic Corporation (Kyshtim, Tanalyk, Ridder, Ekibastus, and the Steppe properties), with all rights previously enjoyed, are returned on a ninety-nine year's concession. The Russian Government will assist in the reinstatement of working capital and rehabilitation of the enterprises. Financial assistance is fixed at Rs. 20,000,000 gold, £150,000 being payable in cash and the balance in fifteen-year interest-bearing gold bonds. The latter amount is subject to the findings of a special mixed commission which will leave soon for the properties to ascertain locally the amount of loss sustained. As regards labor the company complies with state regulations. The company may freely engage and discharge workmen and employees, and workmen's committees are not to be allowed to interfere in the administration or operation of the enterprises. Royalty and taxation charges are limited to 8 per cent of the gross sales value of the products, a certain minimum production being guaranteed. The agreement is subject to formal ratification by the Council of People's Commissars in Moscow.

Working well up to capacity of 250 tons daily, the San Francisco Mines of Mexico is now earning fairly substantial profits. During August the return was for four weeks only. For the last three months the comparison is as follows:

	Ore	Concentrates				Capital
	Tons	Tons	Revenue	Expenses	Profit	Expenditure
June	8,100	1,950	$98,270	$47,045	$51,225	$19,250
July	6,650	1,520	80,655	37,020	43,635	6,195
Aug.	6,500	1,270	70,180	39,850	30,300	4,890

Capital expenditure includes development, and the decrease may possibly signify that development only is being undertaken. The new plant started on Jan. 6, and apparently all adjustments have now been made. Knox & Allen estimated that the return from the smelter would amount to $12.22 per ton of crude ore, at a cost, including development, of $4 per ton. The average figures for the period taken are

	Revenue	Operating Expenses	Operating Profit
June	$12.13	$5.80	$6.33
July	12.12	5.56	6.56
August	10.79	6.13	4.66

So far the estimate has not been fulfilled, but it is expected that costs will be reduced. There would appear to have been exceptional circumstances during August. In any case, officials on this side are pleased with the position and prospects, for there is concrete evidence that the ore can be treated profitably.

BURMA

Burma Mines Produced 3,421 Tons of Lead During August

Namtu—The Burma Mines during the month of August mined and milled 16,430 tons of ore, producing 9,002 tons of lead concentrate. A total of 11,447 tons of lead-bearing material was smelted in the blast furnaces, producing 3,982 tons of hard lead for treatment in the refinery. The refinery products were: refined lead, 3,421 tons; refined silver, 368,704 oz.

ONTARIO

Castle, at Cobalt, and Paymaster, at Porcupine, Both Considering Mill Construction

Cobalt—The Victory has cut five veins in the crosscut at 450 ft. Some carry encouraging values.

The Colonial shaft is down 175 ft., and excellent progress is being made. It is expected that this work will establish a record for shaft sinking in northern Ontario.

The Castle has struck high-grade ore at 325 ft.; likewise, this same vein has been cut at 160 ft. Directors are considering the installation of a fifty-ton mill with the expectation that mill heads will run 40 to 50 oz.

The Nipissing is preparing to open No. 26 shaft, where high-grade ore was found in the early days. The company has recently been exploring the lower formations in the vicinity with diamond drills and will continue exploration from the shaft.

During the week ending Sept. 8 three companies shipped ore from Cobalt. The Nipissing shipped 479,000 lb. of residues, the Mining Corporation 365,000 lb. of residues, and La Rose shipped 80,000 lb. of high-grade ore.

Kirkland Lake—Officials of the Orr property state that no negotiations are under way with a view to a merger with the Teck Hughes. It is understood that the Orr is being held at over $1,000,000. The property adjoins the Teck Hughes.

Wright-Hargreaves directors have declared a 5 per cent dividend, payable Oct. 1 to shareholders of record Sept. 17. This makes 15 per cent for the year, notwithstanding the fact that the property started production only sixteen months ago.

Teck Hughes may start dividends soon, if the wishes of some of the influential bond holders are met. The company is making substantial profits.

The Northland Gold Mines, in Gauthier Township, is planning extensive development.

Porcupine—A rich discovery is reported from the 300 level of the Paymaster property. Officials say that sufficient ore has been developed to justify the erection of a mill.

Crosscutting has been started on the 125 level of the Rochester, which adjoins the Hollinger. It is expected that several veins will be cut.

BRITISH COLUMBIA

Railway Strikes in U. S. Close Rock Candy Fluorspar Mine—Canadian Copper Financing Progresses

Grand Forks—The Consolidated Mining & Smelting Co. has closed its Rock Candy mine and mill, at Lynch Creek, because the railway shopmen's strike has made it impossible to ship the fluorspar concentrate to Gary, Ill. When the mine was reopened, a few months ago, it was announced that the company had a contract from steel manufacturing concerns at Gary that would keep the mine in operation for at least twelve months, so it may be presumed that the mine will be reopened as soon as the strike is settled.

Hope—The new mill and tramway at the Emancipation mine is said to be giving complete satisfaction, and weekly shipments of gold are now being made from the property.

Princeton — Reorganization of the Canada Copper Corporation indicates renewed activity in this district. This property has developed 10,000,000 tons of ore, containing copper and gold, according to engineers' estimates, and is equipped with a 2,000-ton concentrating mill. According to reports, more than a majority of first-mortgage bonds have been deposited with the Equitable Trust Co., so that foreclosure proceedings may be instituted immediately. Substantial subscriptions to stock in the new company have been received, and it is believed that the full amount of stock of the new company as contemplated under the reorganization plan will be subscribed. The property is developed by a long tunnel with numerous raises and drifts and is served by a railroad and electric-power line.

MEXICO

New Mining Titles in Six Months Numbered 1,012—Four Companies Pay Dividends

Mexico City—According to a statement given out from the mining section of the Department of Industry and Commerce, 1,012 titles for new mining properties were issued during the first six months of this year. These titles embrace an area of 14,830 hectares, or mining claims of 2½ acres each. Of these properties the State of Chihuahua has 254; Sonora, 249; Durango, 78; Jalisco, 65; Zacatecas, 63; and Sinaloa, 55. About 10 per cent of the above have been acquired by Americans, for themselves or for companies they represent.

The following mining companies have declared dividends now payable: Victoria y Anexas, at San Pedro, coupon 175, $1; Socavon de San Fernando, coupon 5, $2; Cia. Exportadora de Minas, dividend 6, $14; Negociacion Minera Socavon de San Fernando, coupon 6, $2, and La Victoria y Onexas of San Pedro, dividend 176, $1.

Hermosillo—A meeting of the Aliados Mining Co. was held here recently for the purpose of approving the contract with F. N. Cox for mining operations on its properties. J. B. Recauzone, of Hermosillo, is president of this company, which is financed largely by Americans.

William L. Daniels, of Douglas, Ariz., representing the Cerro Gordo Mining Co., has filed on the abandoned San Sabas mine, in the municipality of Agua Prieta. This property is near the Argentine mine and others owned by the Cerro Gordo company. The ore contains gold, silver, and lead, and the mine was once a paying enterprise.

The Mint mine, situated about five kilometers from the station of La Bonancita, has been acquired by J. Leroy Drug, of Glendale, Calif.

The Nacozari Mining & Reduction Co., represented by B. F. Parker, has taken up an extension of the Santa Eduwigs property about two and one-half miles southeast of Pilares de Nacozari. The new filing is recorded as the Chileno; it comprises twelve claims traversed by several veins of gold-silver ore. The survey is being made by R. S. Clinch, of Nacozari de Garcia.

El Oro—The mines of the Compañia Esperanza, S. A., are still maintaining a large output. Under the management of Charles Hoyle, the company recently introduced the caving system of mining, thereby materially reducing its mining costs. Paul Avery, mill superintendent, is making changes in the flow sheet of the mill. As soon as these changes are completed the ore will be crushed to a maximum size of 2 in., followed by a 48-in. vertical Symons disk crusher and rod mills just installed. Tube mills will be used for grinding. With the installation of the Symons crusher, the use of the stamp batteries will be discontinued. When these changes are in effect, it is predicted that production costs will be as low as any in Mexico.

NEVADA

Tonopah Divide Shipped $43 Ore in August—Hilltop Mine Developing Well

By Our Special Correspondent

Leadville—Five carloads of concentrates were shipped during August by the Leadville Mines Co. Mill tonnage for the month was 1,129 tons. The average content of the ore milled was 28.08 oz. silver and 6.5 per cent lead. The average recovery was about 92.5 per cent. Underground conditions are good, a new and promising stope has been started 900 ft. from the shaft, and No. 12 stope from the 400 level continues to produce good ore. The main drifts on the 300 and 400 levels are in mill ore. Preparations are being made to work continuously during the winter.

Divide—August shipments of the Tonopah Divide Mining Co. totaled 1,645 tons; average value, $43.72 per ton; gross value, $71,917; net profit, $38,401.52. Cash in blank is given as $292,000. The higher grade of ore being shipped at present is justified by recent developments, and this grade is to be maintained for the time being. Plans for the construction of a mill are being delayed pending developments on the lower levels. On the 1,000 level the vein was cut in a crosscut at a distance of 170 ft. from the shaft, and on the 1,400 level the crosscut is now out 450 ft. from the shaft without any change. It is considered likely that the vein has flattened below the 1,000 level.

Hornsilver—The property of the Southwestern Mines Co. at Hornsilver, which adjoins the Orleans property, has been sold at receiver's sale to Charles S. Stoneham of New York for $7,500. Reorganization plans are being made.

Goldfield—The Silver Pick has shipped approximately $80,000 worth of ore from its lease on Red Top ground of the Goldfield Consolidated. High-grade ore in sight is practically exhausted, and determined efforts are being made to find a continuation of the orebody and to discover others.

Hill Top—The Hilltop Nevada Mining Co. has completed its main transportation tunnel, and is now ready to raise 400 ft. to the orebody, which has been developed on several levels. Ore will be hauled directly to the new concentrator, which is 65 per cent complete. The power house and shop buildings are finished, and also the new ore bins. The mill has a capacity of 150 tons per day. The work is in charge of A. R. Kohlmetz, who is general superintendent.

Pioche—Shipments from the Pioche district again made a substantial advance, approximating 2,000 tons for the week ending Sept. 21. Shipments from Bullionville have not as yet been resumed, nor is any ore being shipped from the Combined Metals mine. Companies sent out the following tonnages: Prince Consolidated, 1,050; tons; Bristol Silver Mines Co., 850 tons; and Mendha Mining Co., 45 tons, a total of 1,945 tons.

Ely—A wage increase of 50c. per shift went into effect at Ruth and McGill, Nev., on Sept. 16, when the Nevada Consolidated raised wages of all mine, mill, and smelter employees. Mill operators under the new scale will receive $4.25 per shift and underground miners $4.75. The monthly payroll is about $165,000.

CALIFORNIA

Walker Mine Produces 200 Tons Per Day—$1,327,623 Is Net Output of California Rand Silver for Last Twelve Months

Special Correspondence

San Francisco—Interest has been centered on the Argonaut disaster to the exclusion of everything else. Mining interests of the entire West have expressed sympathy to the Argonaut Mining Co. and have extended every means in their power to assist.

The semi-annual report of the Engels Copper Mining Co. states that 173,435 dry tons of ore was milled during the six months ended June 30. Concentrates produced totaled 11,816 tons, from which were recovered 6,763,783 lb. of copper, 98,097 oz. of silver, and 919.3 oz. of gold. The copper output was 28 per cent higher than for the same period of 1921. The period closed with operating earnings of $97,002.

The Walker Copper Co. is mining in excess of 200 tons per day and is employing more than 200 men. The enlargement of the concentrating mill to 300-ton capacity is under consideration.

An air compressor and drills have been received at Redding, Calif., and will be hauled to the Chicago silver mine, now being operated by the California Bi-Metallic Corporation. Operations have been resumed at the Gold Leaf mine, near Redding, after a recent fire, which destroyed the surface plant with the exception of the hoisting building. Work has been resumed upon the Bell Cow, at Ono, Shasta County.

At the annual meeting of the stockholders of the California Rand Silver Co., Inc., the following directors were elected: B. H. Sill, J. J. Nosser, W. H. Williams, J. A. Hughes, Alfred Harrell, E. T. Grady, F. B. Chapin, W. H. Coons, and Alex Wark. At the directors' meeting following the stockholders' meeting officers were elected as follows: Alfred Harrell, president; Dwight L. Clarke, secretary; J. A. Hughes, W. H. Williams, J. J. Nosser, vice-presidents; Security Trust Company, treasurer. Production for the last year is reported to have been 14,000 tons of ore shipped; 33,000 tons milled; and net production $1,327,623 for the year ended Sept. 1. The total net production for the property in three years was $3,305,540. The mill was constructed in 112 days, at a cost of $110,000, and it produced concentrates of a gross value of $458,953 during the first nine months of steady operation.

The Angels Camp Deep Mining Co. is without funds and has therefore suspended operations, closing down its property near Angels Camp indefinitely.

ARIZONA

Magma Copper Co. Drilling Virgin Ground in San Tan Mountains —El Tiro to Resume

Phoenix—Magma Copper is reported to be diamond drilling on new ground a few miles southwest of Magma station, the point where its new railroad to Superior connects with the Arizona Eastern system. The new ground is in the San Tan Mountains, a short distance north of the Gila River, and about sixty miles southwest of Phoenix. The mountains, as far as the reservation line, have been prospected for years past, and are known to contain many gold veins. Magma has dismantled the surface plant of the Lake Superior & Arizona, in Queen Creek canyon, a short distance above Superior. The property now is owned by the Magma, and can be reached at depth by the extension of Magma workings.

Globe — Old Dominion is working about 750 men and is producing about 2,700,000 lb. of copper a month; this is expected to be increased somewhat by increased efficiency of mill operation.

The New Dominion Mines Co., which lately transferred a number of mining claims in the Gibson section west of Miami, has no connection with the New Dominion Copper Co., which is reported to be resuming operations on its ground near the Old Dominion, a short distance north of Globe. Development on the latter property is understood to have been assured by the raising of $100,000 in New York.

Jerome—The plan for the absorption of the Hull Copper Co. by the United Verde has apparently been completed. Deeds have been filed transferring about twenty claims, including the Cleopatra, to Louis S. Cates, of the Utah Copper Co., who in turn has transferred all but three claims to the United Verde. This transfer materially enlarges the surface holdings of the United Verde, and is believed to have added much valuable ore as well. Just why Mr. Cates should have been chosen as intermediary has not been disclosed. On the 600 level of the Verde Central has been found a large deposit of schist carrying about 4 per cent copper.

Tucson—The El Tiro Copper property, at Silver Bell, will resume production as soon as the workings can be pumped, according to Percy Williams, manager, who recently returned from New York. Ore will be shipped to the Hayden smelter, shipments being gradually increased to 200 tons a day, compared with 100 tons before the shutdown, eighteen months ago. There is no intimation of activity in the Silver Bell mines of the American Smelting & Refining Co., which also owns the smelting plant at Sasco, on the route of the twenty-three-mile railroad that connects Silver Bell with Red Rock on the Southern Pacific main line, twenty-three miles distant.

Kingman — Frank A. Garbutt has started work on the Tennessee mine, at Chloride, a part of the Schuylkill group lately purchased by him at sheriff's sale. The Tennessee is said to have developed more than 30,000 tons of high-grade zinc ore.

WASHINGTON

New Tariff Will Help Magnesite Producers

Chewelah—The new tariff on magnesite imposes a duty of $11.50 for dead burned and $12.50 for the calcined product. According to F. M. Handy, manager of the Western Materials Co., domestic producers and refiners of magnesite will have a slight advantage in a greater part of the United States when freight rates are reduced, and will be on an even footing with foreign magnesite on the Eastern seaboard, because of water rates.

IDAHO

Marshall Lake Region Being Developed —Pine Creek Activity

Grangeville—Revival of gold mining in an isolated district of central Idaho is indicated by recent reports from the Marshall Lake region, which lies midway between the historic placer camps of Warren and Florence, according to reports of E. W. Griffith, of Grangeville. Competition is keen, and some of the largest mining companies are among the negotiators who are reported as bonding promising properties of the district. The Hope mine, with a small stamp mill, is producing $40,000 per year net, and has operated on this basis for the last five years. Twenty miles north of Marshall Lake, in the Buffalo Hump district, the War Eagle property is being developed by George W. Bancroft, of Denver, Colo. It is claimed that 6 ft. of $100 gold ore is being followed. The property is rapidly being put in condition to warrant the erection of a stamp mill. Representatives of Seeley W. Mudd, of Los Angeles, recently completed examination of the War Eagle and other properties of the vicinity. Completion of a wagon road is the greatest single step that will help develop the district.

Priest River—Prospecting and development work has been active in the Pine Creek gold properties this season. Tom Judge has been working steadily this summer developing his property, and John Lloyd has driven 900 ft. on the Camp Bird crosscut, which is rapidly approaching the vein exposed on the surface. E. Sappington is preparing to begin operations on the Cuban mine. The Redman mine is working steadily on development work. Gold ore assaying $300 is reported in the vein of the Tiger Group.

Buffalo Hump—Representatives of the American Smelting & Refining Co. and other large financial interests, represented by Park & Chanler, of New York, have been active lately on Bear Creek, in the Marshall Lake district, and south of Buffalo Hump. It is understood that the opposing factions have been bidding briskly against each other for mining property.

UTAH

Six Mines Are Shipping from the Cottonwood Districts—Tintic Standard Declares Dividend

Park City—The Silver King Coalition Mines Co., according to the policy outlined at a recent directors' meeting by W. Mont Forry, managing director, will accumulate a large surplus before starting regular dividend payments. There is at present a substantial sum in the treasury, and this will be increased until the beginning of the coming year, when the announcement of a dividend policy may be expected. The company intends to keep up extensive development work.

Alta—Shipments are being made by the following mines in Big and Little Cottonwood canyons: Cardiff, Alta Tunnel and Transportation, Columbus-Rexall, Wasatch Mines, Michigan-Utah, and South Hecla. Work is being done at the Emma, Louise, Peruvian, Alta-Peruvian, West Toledo, Woodlawn, Big Cottonwood Coalition, and Big Cottonwood Bonanza.

Eureka—Tintic shipments for the week ended Sept. 15 amounted to 157 cars. Shippers were: Chief Consolidated, 44; Tintic Standard, 25; Grand Central, 19; Dragon, 10; Victoria, 8; Iron Blossom, 7; Colorado, 6; Eagle & Blue Bell, 5; Swansea, 5; Gemini, 3; Mammoth, 3; Joe Bowers, 1; Sunbeam, 1; Republic, 1; Tintic Drain Tunnel, 1; American Star, 1; Chief Consolidated, limestone, 17.

The Tintic Standard will pay a dividend of 5c. a share—$58,735—on Sept. 30. This brings the total by the company to $1,714,547.

Bingham — Shipments by Bingham mines, exclusive of the Utah Copper and Utah Consolidated, for the week ended Sept. 16 amounted to 77 cars. Shippers were: United States company, 44 cars; Utah Apex, 20; Bingham Mines, 8; Montana-Bingham, 5.

MONTANA

Butte—The current output of the Anaconda company is now about 15,000,000 lb. of copper a month, or 60 per cent of capacity. The obtaining of enough miners to bring the output above 70 per cent would decrease costs materially. With an output of 20,000,000 lb. a month, or about 80 per cent of capacity, it is believed by officials that despite higher wage level and cost of materials Anaconda could make copper at less than 12c. a pound, exclusive of amortization. Anaconda is employing 5,000 men underground, and at its mines, concentrators, smelters, refineries, coal mines, lumber camps and mills in Montana a total of about 8,000 men. The electrolytic zinc output at the Great Falls refinery is between 10,000,000 and 11,000,000 lb. a month, as the plant is about at capacity. Most of the zinc concentrates treated come from the Butte & Superior and the Elm Orlu mines at Butte. Anaconda is mining only a small tonnage of zinc ore from its own mines.

COLORADO

Portland Will Deepen Shaft 125 ft.—Experienced Miners Are Needed

Cripple Creek—Encouraged by the results of the strike on the 2,600 level which has now been explored by over 500 ft. of drifting, the Portland company announces that next month sinking will start on an additional 125 ft. of the main shaft. It is stated that good ore has been found at practically every point on the present level, and there is every indication that it will continue to a greater depth. Another shift will be added Oct. 1.

A shortage of experienced miners, particularly of machine men, is retarding production in the Cripple Creek district. The recent advance of 50c. in the wage (now $4.75) for machine men and timbermen by the Cresson company has not resulted in a full complement of men. Although there is a shortage of several hundred men in the district, the operators are seeking only the experienced miners. Machine men must be procured before muckers can find employment.

A strike of high-grade ore by leasers on the Jerry Johnson is directing much attention to Ironclad Hill. A sample from a 4-in. core gave the extraordinary assay of 5,454 oz. gold.

Leadville—Much anxiety is felt by mine operators as the result of a drastic order which became effective Sept. 17, whereby all ore cars employed by the Denver & Rio Grande R.R. in the Leadville district suitable for hauling coal were withdrawn and sent out of the district. The railroad company announced that it is acting under orders of the Interstate Commerce Commission in giving priority to the movement of food, feed, livestock, perishable products, and fuel. Cars unfit for main line traffic remain in the district sufficient to provide for local movement of ore to the smelter, and immediate steps have been taken by the Chamber of Commerce to prevent any serious embargo on shipments of mine products.

MICHIGAN

Calumet Hecla Increases Current Production—Richer Ore Mined

BY M. W. YOUNGS

Houghton—A more optimistic feeling prevails in the Michigan copper district since the advance in wages by the Copper Range and Quincy companies, and it is generally believed that conditions will continue to improve. The Calumet & Hecla mines and Mohawk and Wolverine will soon announce an adjustment of wages, which will be retroactive to Sept. 15.

Calumet & Hecla will show an increase in production this month, due principally to the richness of rock now being mined. Much of this rock is coming from upper levels, from the backs of stopes and pillars, which returned a yield as high as 75 to 80 lb. to the ton in the early days of the property. Rock coming from the bottom of Nos. 6 and 7 shafts, Hecla, in which sinking is under way, also is rich. This development is important because it shows the continuity of rich values at depth in the conglomerate lode.

Mohawk is showing a gain in men with the approach of fall, having added more than 10 per cent to its underground organization in August. This increase will soon be reflected in production. Operations are confined to Nos. 5 and 6 shafts, in which the rock is high grade. Considerable mass also is being hoisted, bringing the yield in August up to 24 lb. to the ton. The average yield for the year probably will be between 21 and 22 pounds.

Marquette Range

Michigamme—Mining operations are now suspended at Henry Ford's Imperial mine, all work ceasing underground when the automobile factory was closed. About fifty men were kept on the payroll to carry on the construction program, which consists of the erection of a number of new dwellings and a new power plant. The coal situation did not affect the Imperial because waste lumber from the body-plant mill at Iron Mountain is used for fuel.

Menominee Range

Iron Mountain—Shipments of iron ore have been started from the Section 6 mine of the Monroe Mining Co. Operations were started about two weeks ago, sixty men being employed in the pit. About 500 tons will be shipped daily until the close of navigation, unless there should be a strike of the Lake seamen.

Iron River—A cage is being used instead of a bucket in sinking operations at the Spies mine of the Cleveland-Cliffs Iron Co. The cage is guided by two crossheads, one above the cage and one below. A car is used to bring the muck to surface and to handle the supplies going down. This method is considered far more safe than a bucket, and was used first in the sinking of the Athens mine, at Negaunee, and later at the Barnes-Hecker, at Ishpeming. The shaft is to be put down from 450 to 1,250 ft. No mining is being done at present, but ore in stock is being shipped.

Gogebic Range

Ironwood—The Thomas Furnace Co., of Milwaukee, is making preparations to reopen the Morgan mine with a crew of sixty or seventy men. The mine has been closed for two years, because at that time it was impossible to get railroad tracks built in to the mine; later, the depression came on. The property is several miles east of Wakefield, being further east than any other mine now on the range. However, exploratory work is being done in this territory, and it is possible that the producing section of the range will soon be extended eastward.

The companies operating on this range have advanced wages from 10 to 15 per cent for most classes of labor, and in most cases the raise has been made effective as of Sept. 1.

JOPLIN-MIAMI DISTRICT

McConnell Mine To Be Reopened—New Shaft for Underwriters

Miami—The Golden Rod Mining & Smelting Co. is preparing to reopen the old McConnell ground at its No. 3 property. The McConnell was the first mine in what is now Picher, having been opened as an extension of the Commerce field, north of Miami, about 1915. The dirt taken from it by the Golden Rod company will be mined over the Golden Rod No. 7 mill.

The Federal M. & S. Co. is drilling out a lease to the east of its Brewster mine, south of Hockerville, Okla. The tract is separated from the Brewster mill by a forty-acre lease belonging to the Huttig company, but if a showing warranting development is made, a surface railroad will be laid and the dirt handled over the Brewster mill.

The Skelton Lead & Zinc Co. is repairing its No. 4 mill at Douthat, preparatory to placing it in operation once more after an idleness of many months. Frank Childress is manager.

The Underwriters Land Co. has started the sinking of a new shaft on the northeast portion of its No. 2 lease after a drilling campaign that included the sinking of a dozen holes. It is planned to erect a derrick and hopper at the shaft and run the dirt over a surface railroad, to be built, to the mill on the south part of the forty-acre lease. F. N. Bendelari is manager.

The Commerce Mining & Royalty Co. is continuing its drilling development operations on the blue mound north of its West Side mine, which has proved one of the rich properties of the district. This is in Kansas, near the rich mine of the Vinegar Hill Zinc Co., the so-called "blue mound" being one of the landmarks of the section.

MINNESOTA

Spring Mine, at Aurora, Is Reopened

Hibbing—Ore shipments at the Buffalo-Susquehanna open-pit, a property of the Rogers Brown Iron Mining Co., have been completed for this shipping season. The various crews and equipment were put on stripping operations, which, it is anticipated, will continue during the winter.

Aurora—After a complete close down of several years, the Spring mine is to be reopened by the Kingston Mining Co., which has started preparations for the unwatering of the old workings.

Ely—The Section Thirty Mining Co. has started shipments of ore from its stockpile. Shipments will amount to 100,000 tons, with the greatest proportion going to lower Lake ports. Some will be sent to the Zenith Furnace Co. at Duluth.

The track arrangement leading to shaft "A" of the Pioneer mine of the Oliver Iron Mining Co. is being changed from the present layout so as to afford a more convenient and larger stockpile area, and to permit the mining of that ore which has been tied up in track pillars.

THE MARKET REPORT

Daily Prices of Metals

Sept.	Copper, N. Y., net refinery* Electrolytic	Tin		Lead		Zinc
		99 Per Cent	Straits	N. Y.	St. L.	St. L.
21	13.75	32.25	32.50	6.10@6.25	5.90@6.05	6.775
22	13.75	32.25	32.50	6.25@6.35	6.10	6.80
23	13.75	32.25	32.50	6.25@6.35	6.10	6.85
25	13.75	32.25	32.625	6.25@6.35	6.15	6.85
26	13.75	32.25	32.50	6.25@6.50	6.25	6.875
27	13.75	32.125	32.375	6.35@6.50	6.25	6.875

*These prices correspond to the following quotations for copper delivered: Sept. 21 to 27 inc., 14c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin. Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

London

Sept.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3 M		Spot	3M	Spot	3M	Spot	3M
21	62⅝	63¼	71	160½	161¾	23¾	23¼	31⅞	31¼
22	62⅞	63⅜	71	161	162¼	23¾	23⅜	32⅜	32
25	63¼	63½	71	161½	162¾	23⅞	23½	32⅜	32¼
26	63¼	63½	71	161½	162½	23⅞	23½	32¼	31¾
27	63⅜	63¼	71¼	160⅞	162⅛	24⅛	23⅝	32¼	32

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver and Sterling Exchange

Sept.	Sterling Exchange "Checks"	Silver			Sept.	Sterling Exchange "Checks"	Silver		
		New York Domestic Origin	New York Foreign Origin	London			New York Domestic Origin	New York Foreign Origin	London
21	4.42⅞	99¼	69½	35½	25	4.41⅞	99¼	69½	35⅜
22	4.41⅞	99¼	69⅜	35⅛	26	4.41¼	99¼	69⅜	35⅜
23	4.41½	99¼	69½	35⅜	27	4.40¼	99¼	69⅜	35 5/16

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command one-quarter of a cent premium.

Metal Markets

New York, Sept. 27, 1922

Demand has continued good for all of the non-ferrous metals during the last week. Copper has remained unchanged in price, but lead and zinc have advanced further. Tin continues practically unchanged in both demand and price.

Copper

The copper situation is entirely unchanged from that of last week, although sales have been somewhat larger and producers are even more satisfied with the condition of the market. The price of 14c., delivered, continues to be quoted by practically all producers for delivery where the freight is normal and for shipment within the next two or three months. Some large consumers have been able to have this price shaded down to as low as 13¾c., where their plants have been situated close to refineries; also, for deliveries extending into 1922, prices as low as 13¾c. have been quoted even where the delivery charges are normal. Producers are well satisfied with domestic consumption.

Export demand continues unchanged and at prices to net producers substantially the same figure as on domestic business.

Lead

On Thursday, Sept. 22, the American Smelting & Refining Co. advanced its official contract price of lead from 6.10 to 6.25c., New York, and today, Sept. 27, made a further advance to 6.35c.

The quotations published during the week have been somewhat misleading, as spot prices quoted by dealers have been far above the levels at which lead has actually been placed on the order books of producers, thus causing quotations which are almost entirely nominal to have considerable publicity. For example, on last Friday a small quantity of lead was sold as high as 6.32c., St. Louis, although one consumer would have been able to buy at 5.95c. Most producers are out of the market except for small tonnages to regular customers. The prices which we quote represent those at which the largest amount of actual business was booked, and must not be confounded with the prices which some consumers were asked who had not provided for their full requirements from regular sources. There is no discounting the fact that there is a great scarcity of lead for October shipment and that prices may advance further with the present tone of the market. It is unlikely that consumers are laying in stocks more than sufficient for their needs, but, on the other hand, the demand has been intensified by the fact that car scarcity has led consumers to play safe by booking a little bit more lead than would be required under normal conditions. Ordinarily, the increased price would stimulate production considerably, but it has not had this effect, owing to labor and ore shortage. It is doubtful if the domestic production of lead for this month will exceed 38,000 tons.

Zinc

Demand for zinc was particularly active on Thursday, Friday, and Saturday, but in the last three days the market has quieted down somewhat. There is an idea that the price will be stabilized for a while in the neighborhood of 7c. Present production is nowhere near the peak reached during the war, but this is largely on account of a shortage of labor, and even should the price go higher it will be difficult to increase the production to any marked extent for some time. Furthermore, with the uncertainty of the fuel supply, smelters hesitate to put additional blocks of furnaces into operation. Importations of zinc may be necessary to supply domestic requirements during the next few months. The New York quotation continues at 35 points above that in St. Louis. High-grade zinc has found an active market during the week, and the price was advanced to

7.75c. on Monday. Zinc for December delivery is obtainable at about 5 points' discount.

Tin

There is practically no change in the tin market, and quotations have remained remarkably constant for the week. Practically no American electrolytic is now obtainable, but some may come on the market next month. Tin for forward delivery is quoted at substantially the same prices as are asked for spot.

Arrivals of tin, in long tons: Sept. 20, Liverpool, 25; 22d, London, 25; 25th, Australia, 50; 26th, Straits, 25.

Gold

Gold in London: Sept. 21st, 93s; 22d, 93s. 2d; 25th, 93s. 2d.; 26th, 93s. 5d.; 27th, 93s. 5d.

Foreign Exchange

The Near East situation has lent a heavy tone to foreign exchanges, but their steadiness indicates that no grave international complications are feared. On Tuesday, Sept. 26, francs were 7.6375c.; lire, 4.295c.; marks, 0.06⅝c.; and Canadian dollars, par. Canadian money now seems firmly established as of equal value to the currency of the United States.

Silver

Silver has continued dull and featureless. It is essentially a trading market, with no definite trend indicated. Developments in the Near East have added to the general uncertainty of conditions which affect the price of the metal.

Mexican Dollars.—Sept. 21st, 53⅛; 22d, 53; 23d, 53⅛; 25th, 53⅛; 26th, 53; 27th, 52⅞c.

Other Metals

Quotations cover large wholesale lots unless otherwise specified.

Aluminum—Contract prices by principal interest: 99 per cent, 20.1c. per lb.; 98@99, 19.1c.; 94@98, 18c. Outside market, 99 per cent, 19c.

Antimony — Chinese and Japanese brands, 7c. W.C.C., 7.25@7.50c. Cookson's "C" grade, 9c.

Bismuth—$2.20 per lb.

Cadmium—Quiet at $1.15 per lb.

Iridium—$275@$300 per oz. Nominal.

Nickel—Standard market, ingot and shot, 36c.; electrolytic, 39c. Outside market, 32@34c. per lb.

Palladium—$55 per oz.

Platinum—$118 per oz.

Quicksilver—$70 per 75-lb. flask. Market firm. San Francisco wires $68.70.

Selenium—$1.80@$1.90 per lb.

Tellurium—$1.75 per lb.

Tungsten—Powder, 90c.@$1 per lb.

The prices of Cobalt, Magnesium, Molybdenum, Monel Metal, Osmium, Rhodium, and Thallium are unchanged from prices given Sept. 2.

Metallic Ores

Chrome Ore—Indian chrome ore, $18 per ton, c.i.f. Atlantic ports. Rhodesian and New Caledonian, $23 and $25 per ton. Market quiet.

Manganese Ore—29c. per long ton unit, seaport, plus duty; equivalent to about 45c. Chemical ore, $70@$75 per gross ton.

Molybdenum Ore—50@55c. per lb. of MoS_2 for 85 per cent MoS_2 concentrates, plus duty; equivalent to 80@85c. per lb.

Tungsten Ore—Chinese ore, $6.50@$6.75 long ton unit of WO_3. Wolframite, $6.25@$6.50.

Iron Ore, Magnetite, Tantalum, Titanium, Uranium, Vanadium, and Zircon ore are unchanged from the quotations published Sept. 2.

Zinc and Lead Ore Markets

Joplin, Mo., Sept. 23—Zinc blende, per ton, high, $41.10; basis 60 per cent zinc, premium, $41; Prime Western, $38.50@$40; fines and slimes, $39@$37; average settling price, all grades of blende, $38.15; calamine, basis 40 per cent zinc, $20@$22.

Lead, high, $85.40; basis 80 per cent lead, $85; average settling price, all grades of lead, $81.12 per ton.

Shipments for the week: Blende, 6,394; calamine, 44; lead, 1,983 tons. Value, all ores the week, $405,800.

The shipment dropped 2,500 tons from the previous week because of lack of cars. Heavy demand for box cars from grain shippers, together with shortage caused by the strike, has finally reached a stage that is causing ore shippers much anxiety and great inconvenience. Smelters are asking for ore to prevent closing down furnaces and shippers are contending for cars far beyond the supply, in an effort to meet that demand. This is the first week the situation has presented a really critical aspect, with no promise of betterment soon.

The usual weekly **Platteville, Wis.,** market report had not been received up to the time of our going to press.

Non-Metallic Minerals

Feldspar—No. 1 pottery, $7@$7.50 per gross ton, f.o.b. North Carolina points. Market fair.

Magnesite—$15 per ton for crude, $35@$37.50 for calcined magnesite, f.o.b. California points. Northwest American magnesite industry has been shut down for the last year.

Talc—200 mesh, $15; 300 mesh, $18.50 per ton, f.o.b. California points.

Asbestos, Barytes, Bauxite, Borax, Chalk, China Clay, Emery, Fluorspar, Fuller's Earth, Graphite, Gypsum, Limestone, Mica, Monazite, Phosphate, Pumice, Pyrites, Silica, and **Sulphur** are unchanged from the prices published Sept. 2.

Mineral Products

Arsenious Oxide (white arsenic)—firm at 9@9¼c. per lb.

Copper Sulphate—Large crystals, 5.85c. per lb.; small, 5.75c.

Sodium Nitrate—$2.25@$2.65 per 100 lb., ex vessel Atlantic ports.

Potassium Sulphate and Sodium Sulphate are unchanged from quotations of Sept. 2.

Ferro-Alloys

Ferromanganese — Domestic, 78@82 per cent, $69@$75 per gross ton, f.o.b., furnace. Spiegeleisen, 19@21 per cent, $39, f.o.b. furnace; 16@19 per cent, $38.

Ferrosilicon—50 per cent, $62@$65 per gross ton, f.o.b. works.

Ferrotungsten—Domestic, 70@80 per cent W, 70@75c. per lb. of contained W, f.o.b. works.

Ferrocerium, Ferrochrome, Ferromolybdenum, Ferrotitanium, Ferrouranium, and Ferrovanadium are unchanged from the prices published Sept. 2.

Metal Products

Copper Sheets—New York base, 21.50c. per lb.; wire, 15.50@15.75c. net.

Lead Sheets—Full lead sheets, 8.75c.; cut lead sheets, 9c. in quantity, mill lots.

Nickel Silver—29c. per lb., for 18 per cent nickel Grade "A" sheets.

Yellow Metal—Dimension sheets, 19.25c.; rods, 16.25c. per lb.

Zinc Sheets—$8.25 per 100 lb., f.o.b. works.

Refractories

Chrome Brick—$50 per net ton, f.o.b. shipping point.

Firebrick—First quality, 9-in. shapes, $35@$40 per 1,000, Pennsylvania, Ohio, Illinois, and Kentucky.

Magnesite Brick—9-in. straights, $60 per net ton, f.o.b. works.

Silica Brick—9-in., per 1,000, $45@$53, f.o.b. shipping points.

Bauxite Brick, Chrome Cement, Magnesite Cement, and Zirkite are unchanged from the prices appearing in the issue of Sept. 2.

The Iron Trade

Pittsburgh, Sept. 26, 1922

Steel-mill operations have now reached a rate of nearly 65 per cent of capacity, against a 50 per cent rate at the end of August, and seem unlikely to increase much more, as the rate of coal movement is practically stationary. The present rate is about 10 per cent above production in 1912 and 1913, the two heaviest tonnage years before the war.

Automobile sheets are in conspicuously good demand and early deliveries command 5.25c., or $5 a ton more than thirty days ago. Wire products and merchant pipe are in good request. Deliveries are slow in pipe.

Pig Iron—The market continues stagnant. There seems to be latent demand, with asking prices too high to permit its expression. The majority of merchant furnaces remain idle, with no immediate prospect of their being able to secure coke. The situation may be relieved by steel works selling pig iron. The market is practically nominal at $34 for bessemer, $30 for basic, and $35 to $36 for foundry, Valley basis.

Connellsville Coke—Prices are higher, at $12 for furnace and $13.50 to $14 for foundry. Retail dealers are buying furnace coke freely.

The Present German Lead Position

Ores and Lead-Bearing Residues Becoming Scarce and Demand for Metal Active

Special Foreign Correspondence

Charlottenburg, Sept. 3, 1922.—In the pre-war days Germany figured as the third greatest world producer of lead, after the United States and Spain, and as the second largest world consumer after the United States. In the year 1913 about 100,000 metric tons of lead was mined by working German lead-zinc ores, and 143,000 tons of foreign ores was imported and smelted in the country, of which 127,000 tons originated in Australia. Half of the German ores were derived from Upper Silesia. It may be of interest to ascertain how things stand now.

It should be common knowledge across the Atlantic that Germany continues to be a very large exporter of lead products, for its electrical trades are as busy as ever, and, at the same time, the use of this metal for the manufacture of tubes, hard lead, type metal, babbitt, solder, and dyes is absorbing huge quantities of lead. But in view of the disinclination of Australia to resume its former business relations with Germany, the latter is compelled to work off scrap and residues containing large amounts of lead. Down to July of the current year the importation of lead and lead ores from Spain and Mexico, and also from Great Britain and the United States, had been proceeding on a large scale. Since then, however, matters have gone from bad to worse by the progressive depreciation in the value of the mark, necessitating the expenditure of tremendous sums to buy foreign materials.

In June, Upper Silesia was handed over to the Poles, who, by a subsequent agreement, are pledged to allow the transfer of eastern Silesian ores to western refineries. But practically this has proved of no advantage, as the railways on the borders are heavily congested. As for western German mines, the district of Moresnet, with its rich deposits, has been given over to Belgium, so that there is only a last resort to the Rheinish-Nassovian producers, as well as to those situated in the Harz district and Saxony. The latter area, especially that of Lautensthal, has meanwhile become lean of pure lead, because the "eyes have been taken" out of it during the high-speed production of war time. The same may be said in a minor degree of the areas belonging to companies of the Rheinish-Nassauische Bergwerks und Hütten Akt. Ges. and Aktiengesellschaft für Zinkfabrikation, in Stolberg. In the lower levels of the last-named areas, the zinc content in the ores preponderates.

There exists, also, a small proportion of lead-producing mines in the Schwarzwald and in the Erzgebirge, but the amount of metal turned out there is negligible. The aggregate amount of virgin pig lead produced in Germany may be put for this year at from 22,000 to 25,000 metric tons, whereas the consumptive power is 200,000 metric tons, and the actual demand amounts to 150,000 metric tons. It is true that the activities of lead producers in Austria are diminishing rapidly on account of a stringent shortness of coal and ready money. Nevertheless, the bulk of the demand for lead exceeds by far the possible supply, even if the secondary production, which I mentioned above, is taken into consideration. At present there is a mushroom-like movement to establish smelters of small and large dimensions, aspiring to avail themselves of the exceptional opportunity of the existing strong demand. This movement is, of course, facilitated by the fact that lead smelting is comparatively easy from a technical point of view, and does not require expensive or elaborate building or installation. Secondary lead is, it is true, also turned out in good qualities by large establishments, such as the brands of the Hüttenwerke Kayser (near Berlin), Hüttenwerke Tempelhof Meyer, Bleiwerke Braubach, and other brands which are sold under the name of "Berliner Blei" or "Raffinadeblei."

Secondary lead of this kind is naturally different from virgin lead, but serves in many industries as an acceptable substitute. Unfortunately, the production of this grade of lead at present is as low as 40,000 to 50,000 metric tons. Accordingly, it is inadequate to supply the demands of lead users. Moreover, the amount of scrap lead available is decreasing rapidly, so that the outlook for lead supplies in Germany is most gloomy. In view, however, of the highly increased smelting and refining capacity with regard to lead as a result of war activity and of the post-war facilities to use up the great quantity of old lead available, hope is being cherished in influential circles here that later on Germany may succeed in concluding contracts for the delivery of ores from overseas.

The Future of Nickel, and the Mond Nickel Co.

The future of the nickel industry in general, and of what the Mond Nickel Co., in particular, is doing to keep its plants operating, is suggested in the following, which is part of a speech made by Robert Mond, J. P., at the eighth general meeting of the company held recently:

"The demand for our most important product, which is metallic nickel, is naturally far less than during the war. In consequence of the acute trade depression and the reduced purchasing power of consumers in those countries which have an enormously depreciated currency, its use for other purposes than for the manufacture of war material has not yet reached the pre-war standard. Owing to these adverse factors there has been only a limited demand for the metal, and the selling price has been unduly low, partly owing to the fact that certain manufacturers have been compelled to liquidate their stocks. Although the general outlook at present is not reassuring, I am of opinion that, with a return to stable conditions in the world and a general trade revival, there is no reason why we should not expect renewed prosperity in the nickel industry, and new uses for the metal, either by itself or in the form of alloys, are constantly being discovered.

"I referred at our last general meeting to nickel coinage in Canada and Italy. The new coins have given great satisfaction, and the coinage has been considerably extended in those countries, and has also been adopted in other countries since we met last year.

"Of course, you will readily understand that some time must elapse until the consumption of metal for peace purposes reaches a tonnage which will enable the present producers to work their plants to their normal capacity. Fortunately, thanks to our unrivaled process and excellent organization, we have every confidence that whatever happens we shall hold our own, and continue to take the share of the trade which we claim we are entitled to, having regard to the extensive mines and smelters we possess in Canada and our large and unique refining plant in this country.

"Among the most important steps we have taken in order to extend the use of nickel, I would mention that we have acquired control of Hy. Wiggin & Co., Ltd., in this country in order to promote new outlets for our nickel and to share in the manufacture of nickel products. For the same reasons we have recently participated in the formation of the American Nickel Corporation, of Clearfield, Pa., whose business it is to manufacture malleable nickel in a variety of forms for use by manufacturers of nickel goods.

"I need hardly mention to you that the potential consumption in the United States is immense, and we fully expect that the technical skill of the management will enable the corporation to produce material of the highest quality, so that the manufacturers of finished nickel goods in America will be in a position not only to compete successfully with articles which were in the past imported from Europe, but largely to extend the use of these articles in the biggest market of the world. We have appointed the corporation our representatives for the sale of raw nickel in the United States, and we are determined to secure our fair share of the market also in that country.

"As regards our other important product, copper sulphate, the market for this has been almost normal as regards tonnage, but the price has kept on a low level for reasons already stated. The sales of precious metals have been well maintained. The costs of production of our products, although much lower than they have been, are still higher than we should like."

COMPANY REPORTS

McIntyre Porcupine Mines, Ltd.

Gold; Ontario

A report of the operations of the McIntyre Porcupine Mines, Ltd., for the year ended June 30, 1922, shows a net profit of $552,746.84.

Balance sheet as of June 30, 1922, is given as follows:

ASSETS			
Fixed assets			
Mining properties		$3,617,254.13	
Plant and equipment at July 1, 1921	$1,447,749.13		
Additions during the year	348,833.20	1,796,582.33	
			$5,413,836.46
Current assets			
Cash in banks and on hand		$66,307.36	
Bullion in transit		186,025.74	
Victory Bonds (Canadian 1934's at par)		300,000.00	
Demand loans		3,600.00	
Account receivable		53,631.60	
Supplies on hand at cost		104,932.27	714,496.97
Investments			
Blue Diamond Coal, Ltd., and Canadian Coalfields, Ltd		279,992.23	
Advances Blue Diamond Coal Co., Ltd		290,000.00	
Sundry other investments		75,002.00	644,994.23
Deferred charges			
Operating and administrative prepayments			31,051.29
			$6,804,378.95
LIABILITIES			
Capital liabilities			
Capital stock authorized 800,000 at $5 par		$4,000,000.00	
Capital stock issued			$3,640,283.00
Current liabilities			
Payrolls payable		$27,735.71	
Accounts payable		72,784.35	
Provision for municipal, provincial and dominion taxes		53,976.02	154,496.08
Reserves			
General reserve		148,987.03	
Reserves for depreciation, plant and equipment		1,183,190.44	
Sundry contingent reserves		39,000.00	1,371,177.47
Surplus			
Surplus as of July 1, 1921		1,646,207.76	
Less			
Dividend No. 14, Sept. 1, 1921, 5 per cent	$182,014.15		
Dividend No. 15, Jan. 2, 1922, 5 per cent	182,014.15		
Dividend No. 16, May 1, 1922, 5 per cent	182,014.15		
Adjustment for taxes for prior years	18,929.33		
Sundry adjustments	799.70	565,771.48	
		$1,080,436.28	
Add workmen's compensation insurance rebate	3,270.56		
Sales of sundry investments	1,968.72		
Net profit current year	552,746.84	557,986.12	1,638,422.40
			$6,804,378.95

Production amounted to 193,971 tons of ore, yielding 93,127.83 oz. of gold and 17,943.35 oz. of silver, of a gross value of $1,937,105.07. Ore reserves are estimated at 718,198 tons, averaging $10.37 in value per ton.

Chile Copper Co.

A statement showing results of the operations of the Chile Exploration Co. for the second quarter of the year 1922 follows:

During the quarter ended June 30, there was treated 924,450 tons of ore, averaging 1.68 per cent copper; in the preceding quarter 620,057 tons, averaging 1.74 per cent copper, was treated. The recovery during this quarter was 89.707 per cent, compared with 93.081 per cent for the quarter ended March 31, 1922. The output by months as compared with the preceding quarter is as follows:

Second Quarter, 1922	Pounds	First Quarter, 1922	Pounds
April	8,592,310	January	5,362,980
May	10,854,729	February	6,877,895
June	11,460,679	March	8,329,732
	30,907,718		20,570,607
Monthly average	10,302,573	Monthly average	6,856,869

The cost of copper produced during the quarter was 7.077c. per lb., including selling and delivery expense but excluding depreciation and federal taxes and with no credit for miscellaneous income, compared with 8.365c. per lb. for the previous quarter.

The financial outcome of the Chile Copper Co. and Chile Exploration Co. combined (earnings being based on copper actually delivered) shows for the quarter ended June 30, as compared with the preceding quarter, as follows:

	Second Quarter 1922	First Quarter 1922
Pounds of copper delivered	38,118,450	23,400,010
Net profit on copper delivered	$1,351,073.26	$329,710.30
Miscellaneous income	15,957.17	35,120.15
Interest on call loans and bank balances	84,372.09	85,535.42
Total income	$1,451,402.52	$450,365.87
Depreciation	$723,869.86	$724,837.57
Amortized discount on fifteen year 6 per cent convertible bonds	35,000.00	35,000.00
Accrued bond interest of Chile Copper Co	787,500.00	787,500.00
Expenses of Chile Copper Co	12,355.00	6,132.84
Total charges	$1,558,724.86	$1,553,470.41
Balance undivided profits for quarter, both companies	$107,322.34 loss	$1,103,104.54 loss

It should be noted that the $107,322.34 loss shown above is the result of including the sum of $723,869.86 for depreciation, which is a book entry computed on a time basis regardless of production or sale. Furthermore, though the cost of copper produced during the quarter was 7.077c. per lb., following the usual method of applying current deliveries against oldest copper in inventory, the income from the copper delivered during this quarter is based on an average cost of 9.244c. per lb. The copper so delivered was produced at this cost when the output of the plant was on a greatly reduced basis.

The companies had at Sept. 1, $12,475,300, representing cash on hand and marketable securities.

Mining Dividends in September, 1922

The following dividends were paid by mining and metallurgical companies during September:

Companies in the United States	Situation	Per Share	Total
American Metal Co	U. S.	$0.75	$401,740
American Metal Co. pfd	U. S.	1.75†	87,500
American Smelting & Refining Co. pfd.	U. S.	1.75†	$75,000
Calumet & Arizona, c.	Ariz.	0.50†	321,261
Federal Mining & Smelting pfd., s. l.	Idaho	1.25†	150,000
Hecla Mining, s. l.	Idaho	0.15†	150,000
Homestake Mining, g.	S. D.	0.25‡	62,790
National Lead	U. S.	1.50†	309,831
National Lead pfd.	U. S.	1.75†	426,433
St. Joseph Lead	Mo.	0.25†	387,342
Texas Gulf Sulphur	Texas	1.00†	635,000
Tintic Standard, s. l.	Utah	0.05	65,000
United Verde Copper	Ariz.	1.50	450,000
Utah Copper	Utah	0.50†	$12,245
Companies in Canada and Mexico:			
Hollinger Consolidated, g.	Ont.	0.05§	246,000
McIntyre-Porcupine, g	Ont.	0.25*	182,014
Lucky Tiger Combination, g.	Sonora	0.07‡	50,074
Premier Gold	B.C.	0.15†	750,000

*Four months. †Quarterly. ‡Monthly. §Four weeks.
g, gold; s, silver; l, lead; c, copper.

All of the companies whose quarterly dividends were due in September made the regular distributions. United Verde Copper paid to its twenty-two shareholders the same dividend paid last December—$1.50. The American Metal distribution is of interest, since this stock was only recently offered to the public, through the New York Stock Exchange.

MINING STOCKS

Week Ended Sept. 23, 1922

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Ahmeek	Boston	63½	62½	62½	Aug. '22, Q	$1.00
Alaska-Br. Col.	N. Y. Curb	3	2¾	3		
Alloues	Boston	24½	24½	24½	Mar. '19	1.00
Anaconda	New York	54½	52⅝	53⅜	Nov. '20, Q	1.00
Arcadian Consol.	Boston	3¼	2½	2½		
Ariz. Com'l.	Boston	8¼	7½	7¾	Oct. '18, Q	0.50
Big Ledge	N. Y. Curb	*9	*8	*8		
Bingham Mines	Boston	17½	17½	17½	Sept. '19, Q	0.25
Calumet & Arizona	Boston	....	....	62	June '22, Q	0.50
Calumet & Hecla	Boston	292	275	280	Aug. '22, Q	5.00
Canada Copper	N. Y. Curb	*3	*2	*2		
Centennial	Boston	†10	†8	9	Dec. '18, SA	1.00
Cerro de Pasco	New York	41	38¼	39¼	Mar. '21, Q	0.50
Chile Copper	New York	26⅛	23¼	26		
Chino	New York	31⅛	29½	29¾	Sept. '20, Q	0.37½
Con. Copper Mines	N. Y. Curb	*25	25	*25		
Copper Range	Boston	41½	39½	40	Mar. '22, Q	1.00
Crystal Copper	Boston Curb	1⅜	1⅛	1⅛		
Davis-Daly	Boston	4½	4½	4½	Mar. '20, Q	0.25
East Butte	Boston	10½	10	10	Dec. '19, A	0.50
First National	Boston Curb	*55	*55	*55	Feb. '19, SA	0.15
Franklin	Boston	2¼	2	2		
Gadsden Copper	Boston Curb	*90	*85	*90		
Granby Consol.	New York	32½	30½	31	May '19, Q	1.25
Greene-Cananea	New York	31½	31	31	Nov. '20, Q	0.50
Hancock	Boston	2	2	2		
Howe Sound	N. Y. Curb	3½	3	3	Jan. '21, Q	0.05
Inspiration Consol.	New York	41⅛	39⅞	40¼	Oct. '20, Q	1.00
Iron Cap	Boston Curb	9½	6½	9	Sep. '20, K	0.25
Isle Royale	Boston	22½	21½	22½	Aug. 22,	0.50
Kennecott	New York	36½	34⅜	35½	Dec. '20, Q	0.50
Kewenaw	Boston	2¼	2	2		
Lake Copper	Boston	4⅜	3⅞	3⅞		
La Salle	Boston	†1⅛	†1⅛	1⅛		
Magma Copper	N. Y. Curb	35½	33½	34	Jan. '19, Q	0.50
Majestic	Boston Curb	*10	*10	*10		
Mason Valley	N. Y. Curb	1⅞	1⅛	1⅛		
Mass. Consolidated	Boston	3	2	2	Nov. '17, Q	1.00
Miami Copper	New York	29½	28½	28½	Aug. '22 Q	0.50
Michigan	Boston	3	2⅜	2⅜		
Mohawk	Boston	61	59¼	60	July '22, Q	1.00
Mother Lode Coa.	N. Y. Curb	....	....	11	June '22, I	0.50
Nevada Consol.	New York	17	16⅛	16⅛	Sept. '20, Q	0.25
New Cornelia	Boston	18⅛	18	18	Aug. '22, K	0.25
North Butte	Boston	11⅛	10⅜	11⅛	Oct. '18, Q	0.25
Ohio Copper	N. Y. Curb	*21	*17	*17		
Old Dominion	Boston	23½	23	23½	Dec. '18, Q	1.00
Osceola	Boston	36	36	36	Aug. '22, Q	1.00
Phelps Dodge	Open Mar.	†175	†163	....	July. '22, Q	1.00
Quincy	Boston	41½	39½	39½	Mar. '20, Q	1.00
Ray Consolidated	New York	15⅝	15½	15½	Dec. '20, Q	0.25
Ray Hercules	N. Y. Curb	1⅜	1⅛	1⅛		
St. Mary's Min. Ld.	Boston	44½	44	44	Apr. '22, K	2.00
Seneca Copper	Boston	....	....	12		
Shannon	Boston	*88	*75	*75	Nov. '17, Q	0.25
Shattuck Arizona	New York	10⅛	8½	9½	Jan. '20, Q	0.25
South Lake	Boston	†1	†*50	*75		
Superior & Boston	Boston	1⅛	1	1		
Tenn. C. & C. cfs	New York	10⅛	9⅞	10	May '18, I	1.00
Tuolumne	Boston	*65	*57	*57	May '13,	0.10
United Verde Ex.	Boston Curb	30½	29½	29½	Aug. '22, Q	0.25
Utah Consol.	Boston	2⅜	2½	2½	Sept. '18,	0.25
Utah Copper	New York	69⅜	67½	67⅜	June '22, Q	0.50
Utah Metal & T.	Boston	1½	1 1/16	1 1/16	Dec. '17,	0.30
Victoria	Boston	1⅛	1	1⅛		
Winona	Boston	1⅛	1⅛	1 1/16		
Wolverine	Boston	11	11	11		
NICKEL-COPPER						
Internat. Nickel	New York	17⅜	16⅞	17⅛	Mar. '19,	0.50
Internat. Nickel, pfd	New York	84½	84	84	Aug. '22, Q	1.50
LEAD						
National Lead	New York	106	103	105	June '22, Q	1.50
National Lead, pfd	New York	115	114½	114½	Sept. '22 Q	1.75
St. Joseph Lead	New York	19	15⅛	18⅛	Sept. '22 Q	0.25
QUICKSILVER						
New Idria	Boston	*40	*40	*40		
ZINC						
Am. Z. L. & S.	New York	21	18⅛	19½	May '20,	1.00
Am. Z. L. & S. pfd.	New York	57	46	55	Nov. '20, Q	1.50
Butte C. & Z.	New York	7⅛	6⅞	7⅛	June '18,	0.50
Butte & Superior	New York	33⅜	30½	32½	Sept. '20,	1.25
Callahan Zn-Ld	New York	9⅜	9⅛	9⅜	Dec. '20, Q	0.50
New Jersey Zn.	N. Y. Curb	156	155	155¾	Aug. '22, Q	2.00
Yellow Pine	Los Angeles	...	...	*50	Sept. '20, Q	0.03

Stock	Exch.	High	Low	Last		Last Div.
GOLD						
Alaska Gold	New York	⅛	⅛	1⅛		
Alaska Juneau	New York	1⅛	1⅛	1⅛		
Atlas	Toronto	*40	*23	*38		
Carson Hill	Boston	9⅛	8⅛	8⅛		
Cresson Consol. G.	N. Y. Curb	2⅛	2⅛	2 1/16	July '22, Q, X	$0.10
Dome Mines	New York	38½	36½	38	July '22, Q	.50
Florence Goldfield	N. Y. Curb	*18	*13	*15		
Golden Cycle	Colo. Springs	*92½	*92½	*92½	June '21, Q	0.02
Goldfield Consol.	N. Y. Curb	*8	*8	*8	Dec. '19,	0.05
Hollinger Consol.	Toronto	13.75	12.80	13.40	Sept. '22,	0.05
Homestake Mining	New York	73	73	73	Aug. '22, M	0.25
Keora	Toronto	*13	*11½	*12		
Kirkland Lake	Toronto	*47	*43½	*47		
Lake Shore	Toronto	2.85	2.65	2.75	Aug. '22, Q	0.02
McIntyre- Porcupine	Toronto	20.00	17.55	18.50	Sept. '22, K	0.25
Porcupine Crown	Toronto	*24½	*21	*23½	July '17,	0.03
Portland	Colo. Springs	*40	*40	*40	Oct. '20, Q	0.01
Schumacher	Toronto	*58	*57	*58		
Silver Pick	N. Y. Curb	*8	*8	*8		
Teck Hughes	Toronto	*92½	*82	*86		
Tom Reed	Los Angeles	*80	*63	*78	Dec. '19,	0.02
United Eastern	N. Y. Curb	1 1/16	1 1/16	1⅛	July '22, Q	0.15
Vindicator Consol.	Colo. Springs	†*5	†*3	*4	Jan. '20, Q	0.01
Vipond Cons.	Toronto	*74	*58	*67		
White Caps Mining	N. Y. Curb	*13	*13	*13		
Wright-Hargreaves	Toronto	3.30	3.00	3.10	July '22,	0.02½
Yukon Gold	N. Y. Curb	*92	*91	*92	June '18,	0.02½
SILVER						
Batopilas Mining	New York	⅛	⅛	⅛	Dec. '07, I	0.12½
Beaver Consol.	Toronto	*38	*30	*37	May '20, K	0.03
Coniagas	Toronto	1.50	1.40	1.45	May '21, Q	0.12½
Crown Reserve	Toronto	*28	*23½	*24	Jan. '17,	0.05
Kerr Lake	N. Y. Curb	3⅛	3⅛	3⅛	July '22, Q	0.12½
La Rose	Toronto	*28	*27	*28	Apr. '22,	0.10
McKinley-Dar.-Sav.	Toronto	*27	*27	*27	Oct. '20, Q	0.03
Mining Corp. Can.	Toronto	1	1	1	Sept. '20, Q	0.12½
Nipissing	N. Y. Curb	6⅛	5⅞	5⅞	July '22, Q, X	0.30
Ontario Silver	New York	7⅛	7	7⅛	Jan. '19, Q	0.50
Ophir Silver	N. Y. Curb	....	....	*12	Jan. '12,	0.10
Temiskaming	Toronto	*39	*35	*37½	Jan. '20, K	0.04
Trethewey	Toronto	*6	*5	*6	Jan. '19,	0.05
GOLD AND SILVER						
Boston & Montana	N. Y. Curb	*11	*10	*10		
Cash Boy	N. Y. Curb	*10	*10	*10		
Cons. Virginia	San Francisco	*17½	*16½	*17½		
Dolores Esperanza	N. Y. Curb	2½	2	2	July '22,	2.50
El Salvador	N. Y. Curb	*13	*10	*10		
Jim Butler	N. Y. Curb	*7	*7	*7	Aug. '18, SA	0.07
Jumbo Extension	N. Y. Curb	*8	*8	*8	June '16,	0.05
MacNamara M.&M.	N. Y. Curb	*8	*8	*8	May '10,	0.02½
Tonopah Belmont	N. Y. Curb	1 1/16	1 1/16	1 1/16	July '22, Q	0.05
Tonopah Divide	N. Y. Curb	*85	*78	*82		
Tonopah Extension	N. Y. Curb	2⅛	2 1/16	2 1/16	July '22, Q	0.05
Tonopah Mining	N. Y. Curb	2 1/16	2 1/16	2 1/16	Apr. '22, SA, X	0.07½
West End Consol.	N. Y. Curb	1⅛	1 1/16	1 1/16	June '22, SA	0.05
SILVER-LEAD						
Caledonia	N. Y. Curb	...	...	*8	Jan. '21, M	0.01
Cardiff M. & M.	Salt Lake	*60	*60	*60	Dec. '20,	0.15
Chief Consol.	Boston Curb	5 1/16	5⅛	5⅛	Aug. '22, Q	0.10
Columbus Rexall	Salt Lake	*22	*19	*19	Aug. '22,	0.03
Consol. M. & S.	Montreal	25⅛	25⅛	25⅛	Oct. '20, Q	0.62½
Daly Mining	Salt Lake	...	†3.00	....	July '20, Q	0.10
Eagle & Blue Bell	Boston Curb	†*5	†*3	*3⅛	Apr. '21, K	0.05
Electric Point	Spokane	*3	*3	*3	May '20, SA	0.03
Federal M. & S.	New York	15⅛	15	15	Jan. '09,	1.50
Federal M. & S. pfd.	New York	62⅛	58⅞	60½	Sept. '22, Q	1.25
Florence Silver	Spokane	*36	*33½	*36	Apr. '19,	0.01½
Grand Central	Salt Lake	†*65	†*60	*61	Jan. '21, K	0.01
Hecla Mining	N. Y. Curb	7⅛	7⅛	7⅛	June '22, Q	0.15
Iron Blossom Con.	N. Y. Curb	...	...	*29	Apr. '22, Q	0.02½
Judge M. & S.	Salt Lake	†3.75	†3.50	3.40	Sept. '20, Q	0.12½
Marsh Mines	N. Y. Curb	*13	*13	*13	June '21, I	0.02
Prince Consol.	Salt Lake	*10½	*9½	*10	Nov. '17,	0.02½
Rambler-Cariboo	Spokane	*4½	*4	*4	Feb. '19,	0.01
Rex Consol.	N. Y. Curb	*9	*8	*8		
Standard Silver-Ld.	N. Y. Curb	*19	*19	*19	Oct. '17,	0.05
Stewart Mines	N. Y. Curb	*8	*7	*7	Dec. '15,	0.05
Tamarack-Custer	Spokane	3.20	3.15	3.20	Jan. '21, K	0.04
Tintic Standard	Salt Lake	2.17½	2.12½	2.17½	Dec. '21, Q	0.05
Utah Apex	Boston	3	2⅛	2⅛	Nov. '20, K	0.25
Wilbert Mining	N. Y. Curb	...	...	*5	Nov. '17,	0.01
VANADIUM						
Vanadium Corp.	New York	51½	47	48¼	Jan. '21, Q	1.00
ASBESTOS						
Asbestos Corp.	Montreal	68	67½	68	July '22, Q	1.50
Asbestos Corp. pfd.	Montreal	....	....	85	July '22, Q	1.75
SULPHUR						
Freeport Texas	New York	24½	22⅛	22⅛	Nov. '19, Q	1.00
Texas Gulf	New York	58½	54½	55½	Sept. '22, QX	1.00
MINING, SMELTING AND REFINING						
Amer. Metal	.....	49⅛	46½	47⅞	Sept. '22,	0.75
Amer. Metal pfd.	.....	112	112	112	Sept. '22, Q	1.75
Amer. Sm. & Ref.	New York	64½	61	62⅜	Mar. '21, Q	1.00
Amer. Sm.& Ref. pfd	New York	103½	102⅛	102⅛	Sept. '22 Q	1.75
Am. Sm. Sec. pfd. A	New York	†98	†94	97	July '22, Q	1.50
U. S. Sm. R. & M.	New York	43	41½	41½	Jan. '21, Q	0.50
U.S. Sm.R.& M. pfd.	New York	48¼	47⅛	48¼	July '22, Q	.87½

*Cents per share. †Bid or asked. Q, Quarterly. SA, Semi-annually. M Monthly. K, Irregular. I, Initial. X, Includes extra.

Toronto quotations courtesy Hamilton B. Wills; Spokane, Pohlman Investment Co; Salt Lake, Stock and Mining Exchange; Los Angeles, Chamber of Mines and Oil; Colorado Springs, The Financial Press, N. Y.

NEW MACHINERY AND INVENTIONS

Modern Development in Portable Loaders

BY H. L. GODDARD

When we consider the utilization of the portable loader for the economical handling of sand, gravel, crushed stone, coal, coke, cinders, slag and other loose materials from ground storage, it is difficult to realize the great strides in engineering and development of this type of equipment that have been accomplished during a period of only twelve years.

Not until 1910 did the demand for mechanical equipment to eliminate hard labor in the handling of loose materials become strong enough to warrant the development of a portable loading device, and in that year the first bucket loader was placed on the market by the Jeffrey Manufacturing Co., of Columbus, Ohio. Although an elevator on wheels was about all the original loader represented, many of these first loaders are still giving satisfactory service.

Up to the year 1914 portable loaders were built by mounting standard bucket elevators on portable structural steel frames and moved from place to place by hitching on behind a wagon. Supporting wheels were woefully small and guiding and controlling mechanism was crude. Take-up boxes at the foot of the elevator interfered so much with the action of the buckets that they could pick up only a limited amount of even loose material, and all hard or semi-packed material had to be shoveled to the buckets. These machines required ideal conditions so as to enable them to travel at all, and hence could not readily be fed into the pile.

The self-propelling device was the first important new feature embodied in the loader and enabled the machine to be moved about with greater ease. The self-propelling feature as first designed had but one speed in either direction. Afterward two speeds were provided, one to move the machine from place to place and the other, the slower one, for feeding into the pile.

For the mounting of present-day loaders a three-point suspension is almost universally used, keeping the machine more stable on rough and soft ground, the latest and most satisfactory arrangement being the substitution of a crawler or caterpillar mounting similar to that used on war tanks, but of a lighter construction and with a three-point support to the frame.

Portable loader for loose materials

The buckets used on the "Tanktred" loader, manufactured by the Jeffrey Manufacturing Co., are of heavy malleable iron and are provided with a steel cutting edge extending well around the ends of the buckets, which protects the buckets from wear and is itself renewable. The whole bucket is so designed that the digging edge has a cutting clearance at all points.

The whole foot of the elevator is so constructed that the buckets are wider than any other part, so that the whole machine can be advanced several feet into the pile with nothing but the clean cutting edge of the buckets coming in contact with the material, and consequently it will handle reasonably hard or frozen material even if it will not flow.

Another distinctive feature of this loader is a relatively large foot wheel, which, by reducing the centrifugal force, enables the buckets to pick up the material, and especially the large lumps, without kicking them away. A flexible wood boom keeps the buckets digging, but will spring enough to release the buckets from overload strain when they encounter a cave-in or such an obstruction as a railroad tie. Two speeds, a traveling speed for moving the machine from place to place and a feeding speed for driving the machine directly into the pile, give flexibility.

A universal swivel spout applied to the Jeffrey loader enables the operator to spot the material in various portions of the truck with little change of position of either the truck or the loader and saves a great deal of time and manual labor in spreading the load. The truck may be driven in front of the loader equipped with this device and every position of the bed may be filled without moving the truck, even if the loader in the meantime had to change position.

To increase the capacity of loading machines by keeping the elevator at work while a full truck is being pulled away and an empty one driven into place, storage hoppers have been developed, so arranged as to catch the discharge from the buckets and provided with a quick-opening valve by means of which the contents of the hopper can be promptly discharged into a truck. These hoppers are sometimes made with adjustable sides, so as to correctly measure material for a batch for concrete-mixing machines.

The machine is equipped for either gas or electric power.

Hoisting a Seventy-five-Ton Locomotive Aboard a Steamer

The dependability of the wire rope sling for hoisting was recently demonstrated, when a seventy-five-ton locomotive was safely hoisted to the deck of a steamer at the Eddystone plant of the Baldwin Locomotive Works. This is the first time a fully completed locomotive has ever been shipped. Shipment in this manner was made necessary, owing to the fact that the locomotive is to be used to draw the special train of the newly elected president of the Argentine Republic, during the inaugural ceremonies, and there was no time for reassembling at the port of disembarkation.

The locomotive is especially finished and decorated. It is painted a royal blue, striped in white, and on its tender it bears the coat of arms of the Argentine Republic. The general finish includes a large amount of nickel work, and in order not to mar the locomotive in any way, the John A. Roebling's Sons Co., of Trenton, N. J., constructed a grommet link special bridle sling to accomplish the purpose. The sling was made from Roebling "Blue Center" steel, and it was equipped with equalizing thimbles, which allowed an even distribution of load. In operation, the sling was perfect in every respect, and the locomotive, while resting therein, was in perfect alignment and balance. The powerful crane used in the operation was also equipped with Roebling hoisting rope.